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FLIGHT

and The AIRCRAFT ENGINEER

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JULY 30th, 1942

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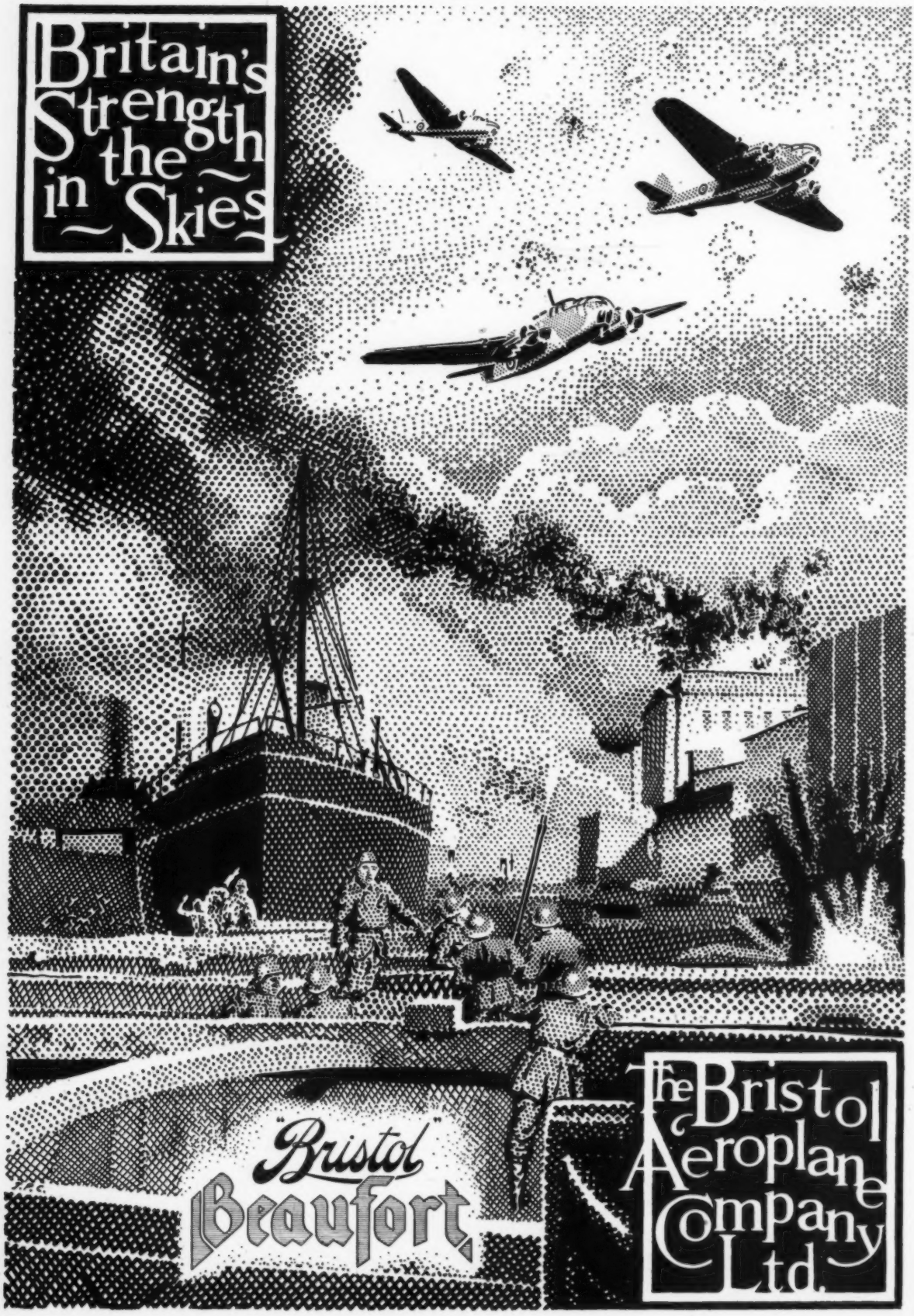
Britain's Strength in the Skies
"Bristol" Beaufort
The Bristol Aeroplane Company Ltd.

FLIGHT and The AIRCRAFT ENGINEER

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The Outlook

Air-cooled Engine Progress

PROGRESS in various countries with air-cooled engines of high-power output would suggest that, at any rate temporarily, liquid-cooled engines may soon be displaced from the proud position they have held for years in medium-altitude high-performance fighters.

Britain, America and Germany, by steady progress and development, have evolved double-row radial-type engines having outputs of approximately 2,000 h.p. This new stage in air-cooled engine development in various countries imbues the aircraft engine position with a fresh interest. The old friendly rivalry is always present, but acquires an added zest whenever a new engine passes its type test.

America has of late months led the field with its examples of air-cooled radials in the 2,000 h.p. class, now well advanced in the production stage. Some have exhaust turbo-superchargers, and such a combination is applied to the Thunderbolt fighter (P47), a type soon to be rendered available to the R.A.F. Germany, with its B.M.W. 801 fourteen-cylinder radial, as fitted in the Fw.190, is ahead in actual operation, but this advantage is likely to be temporary. British engineers also have highly developed radials of greater power than hitherto, already proved and nearing the stage of production. Many may wonder why this turn of events has come about in view of the steady progress with liquid-cooled engines. It is, in part, due to the remarkable development in cowling, but more particularly to the growing dimensions and weight of fighter aircraft better able to accommodate the increasing offensive and defensive armament called for in high-performance, medium-altitude fighters. In such combat types in the 11,000 lb. class the advantages of small frontal area possessed by the V- or H-type engines does not enter so largely into the picture, since general overall dimensions, as already pointed out, are necessarily increased, and consequently the high-powered radial engine and its cowling can be conveniently accommodated.

An exception is the Fw.190, which is a medium-weight fighter with a 37ft. wing span, and an estimated weight of between 8,500 lb. and 9,000 lb. In this case, by the clever design of cowling, assisted by fan cooling and special air ducts, the overall dimensions have been kept remarkably compact, considering that 1,600 h.p. is developed by the engine, which has a swept volume of 42 litres. The result is a machine of unusually high power/weight ratio which makes possible an extremely rapid rate of climb and manœuvrability of an exceptional order. Another new air-cooled engine by B.M.W. is the 802, which has 18 cylinders and a correspondingly higher output. This has not yet been encountered in service.

The portents, therefore, are that in 1943 each of the leading nations at war will equip its fastest fighters with air-cooled engines. There are, however, important considerations to be taken into account. Fighters of large dimensions and high total weight are not so manœuvrable in combat as more compact craft. The most attractive engine cannot give of its best in a compromise aircraft. Practical demonstration indicates that a higher power/weight ratio can now be achieved than hitherto was deemed possible. This characteristic is obviously the one to aim for. The development of the exhaust turbo-supercharger offers new possibilities in this respect by substantially increasing the power output of engines of existing types.

An International Air Force

ON another page of this issue we publish an article by Group Capt. R. E. G. Fulljames, M.C., on the prospects of enforcing the peace of the world by international authority.

The prevention of future wars is a subject in which all men of good will must be interested, and it was definitely alluded to in the Atlantic Charter. It is also certain that any future international authority, whether it be called League of Nations or by some other name, will be impotent unless it has force at its command. That force must include air power, and some think that an international air force by itself would be sufficient for the purpose. Whatever the actual composition of the force most people will probably agree that such a body would be the ideally best thing.

Some ideals, however, are unattainable. The League of Nations itself represented the ideals of many earnest people in 1918, but it proved in practice to be unworkable. Some spheres of conflict were too far away from Europe. Italy's attack on Abyssinia gave a very promising chance for the League to assert its authority, but Laval was then Premier of France, and further comment would be superfluous. And nothing but *force majeure* at the right time could have restrained Hitler.

These cases make one doubt if any new League would be more useful even if it had a force at its disposal. The member States were unwilling to expend their energies over quarrels which did not directly concern them just for the sake of upholding the abstract cause of collective security. It is easy to hold Allies together against one definite enemy, but to marshal the nations against some future hypothetical aggressor is quite another matter.

The same unwillingness to intervene in other people's quarrels would probably be met again if an attempt were made to organise an international air force. In fact, the practical difficulties are very numerous and varied. The whole subject was threshed out in detail by the eminent international lawyer, Mr. J. M. Spaight, in his book *An International Air Force*, published in the early twenties by Gale and Polden. He considered all the forms which such a force might take (and they are numerous) and found no possibility of making any of them into a workable proposition. He ended his preface with the sentence: "An international air force will be seen some day, but that day will not be ours."

However, Mr. Cordell Hull is more hopeful. He has just said that it is a plain fact that "some international agency must be created which can—by force if necessary—keep the peace among the nations in the future." That implies the effective disappearance of isolationism from the United States.

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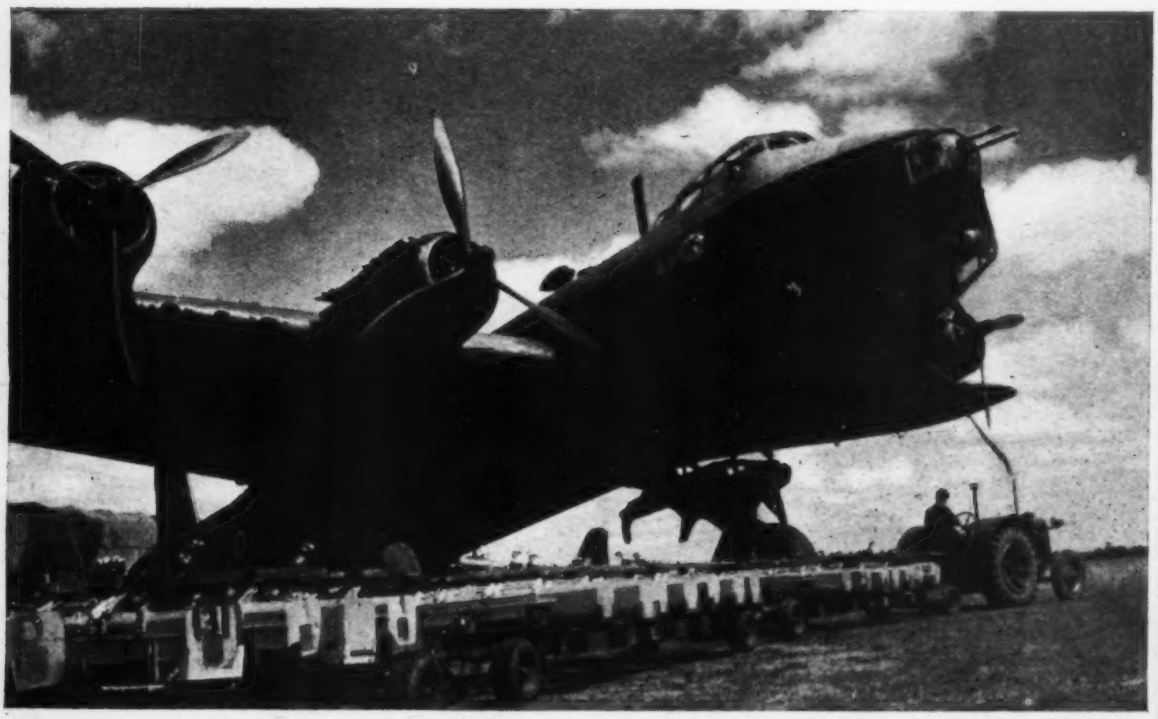


TO LIGHT THE BEACONS: A train of fire bombs in their special containers about to be loaded into a waiting Stirling for a raid on industrial Germany.

War in the Air

SEASIDE ILLUMINATIONS : Searchlights and tracer shells lighting up the night sky of a South Coast town during an air raid.

Bombing Raids in East and West : The Two-front Fight for the Caucasus : Successes of Middle East Air Force

BOMBER Command does not always strike at targets selected by the Admiralty, though anything which impedes the activities of the U-boats is probably the most important service which air power can now render to the cause of the United Nations. There are plenty of other targets which go to make up Germany's war effort, and they get their turn. One night last week the inland port of Duisberg on the Rhine received a visit from some three hundred bombers, including many of the heavy four-engined class, and no less than 50 of the huge 4,000 lb. bombs were let loose on the river port and on the foundries, factories, blast furnaces, etc. The weather was clear over the town, though for much of the way there the bombers flew through clouds, which gave them protection from *flak*, though flying blind puts some strain on the crews. Of course, the bombers came under fire when over the town, and suffered some losses, but the bomb-aimers felt sure that they had hit a number of their special targets, and they certainly started numerous fires. The devastation wrought by a 4,000 lb. bomb is always widespread, whether it scores a direct hit on a particular target building or not.

Russian bombers paid a second visit to Königsberg in East Prussia last week and caused fires and heavy explosions. The Germans have a sentimental affection for East Prussia, the ancient home of the Prussian people, and hate it to suffer from enemy action. In the last war the Russians boldly invaded East Prussia at the outset, and it is held that this sentiment of the Germans led them to send large forces to rescue their beloved nursery, although those forces would have been much more profitably employed in invading France. The result was the Allied victory of the Marne. Hitler, an Austrian by birth, may not share this Prussian weakness, and so the reactions may be different. These two raids suggest that the Russians have now got a certain margin of large bombers which can be spared from the battlefields.

The recent attempt of the *Luftwaffe* to keep Malta quiet while more supplies and reinforcements were being

COMING TO EARTH: Some fine "sticks" of paratroops and supplies dropping from Whitleys at a recent demonstration.

WAR IN THE AIR

hurried across to Rommel proved very expensive in Axis aircraft. In the first three weeks of July no less than 113 machines were destroyed by the Malta defences. Rommel would doubtless have been very glad to have had those machines at his disposal, but he probably wanted the ship-borne supplies and reinforcements even more.

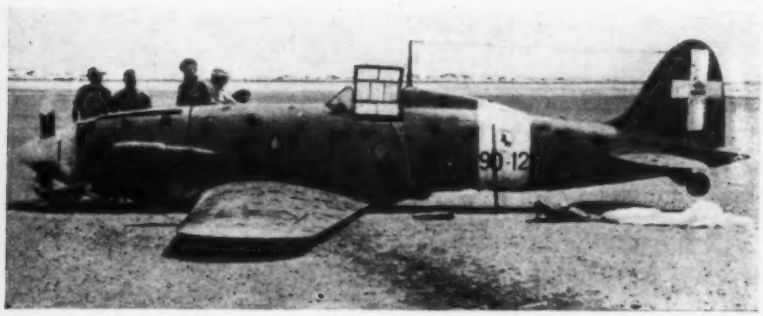
The Middle East

THE Mediterranean Command of the R.A.F. has been subordinated to that of the Middle East during the war, but it has to work independently to a considerable extent, and it has its own Air Officer Commanding. For the past year the A.O.C. has been Air Vice-Marshal H. P. Lloyd, C.B., C.B.E., M.C., D.F.C., and he organised the really wonderful air defence of the island during the very heavy Axis attack. He has also had to deal with much reconnaissance work over the Mediterranean. Now he well deserves a rest and change, and he has been succeeded by Air Vice-Marshal K. R. Park, C.B., M.C., D.F.C., who commanded No. 11 Group of Fighter Command during the Battle of Britain, and therefore knows all that can be learnt in the hard school of experience about using fighters and ground defences to beat off air attacks.

In our last issue it was recorded how General Auchinleck had begun a cautious yet spirited move forward from his position at El Alamein. By the time these words have been published this may have developed into a major battle, but at the moment of writing that does not appear probable. We may guess that the British had received reinforcements and that the General decided to improve his position before still greater reinforcements reached the enemy, as they were probably on the way. So General Auchinleck pushed forward on all sectors of his front, securing stronger positions which had previously been held by the Germans and Italians. He used his armour with caution (for the losses of June 13th cannot yet have been made good), but made the utmost use of his aircraft. Two very determined raids were made by our bombers and fighters on the advanced airfields of the enemy, in which at least 100 aircraft were put out of action, some for good and all, the rest for the time being. That went far towards clearing the air (literally as well as figuratively) and made it possible for General Auchinleck to use his own bombers and fighter-bombers freely as a form of field artillery.

One new tactical development in this struggle was the use of Wellingtons to bomb the enemy's troops during the night. This suggests that heavy German tanks had been spotted by our reconnaissance machines, and really heavy bombs were the treatment required to deal with them. It is known that though the Axis tanks and other vehicles move about in all directions during the day, by night they like to concentrate in laagers of a sort. These concentrations make good targets. Other objectives which have been specially favoured are the mobile tank repair depots which have been moved up near to the front line. Several of these have been knocked out by combinations of bombs, cannon shells and machine-gun fire from the air, with a marked effect on the numbers of vehicles which the Axis has been able to patch up and send back into the battle. At the same time, when an enemy tank is temporarily halted, and there is no assurance that we shall be able to get it away and turn it to our own use, our sappers have developed the art of blowing it up where it lies. That makes it certain that that particular tank will give us no further trouble. In addition, at all times during the day our fighter-bombers have knocked out innumerable supply vehicles, lorries full of infantry, armoured cars, and the lighter varieties of tank. Meantime, our fighters have kept the skies reasonably clear of enemy aircraft. It really seems as if General Auchinleck has discovered the secret of using the R.A.F. to help the Army in a battle, at least a battle in a fairly narrow patch of desert with both his flanks protected by natural obstacles—the sea at Alamein and the Quattara Depression to the south. In other descriptions of battle the tactics may have to be varied. In a wider stretch of desert the targets will not be so concentrated, and if on some other occasion our fighters hold a less definite superiority, then our fighter-bombers will not find their hands so free.

THE GRUMMAN AVENGER : A side view which shows in detail the layout of America's newest torpedo bomber which did so well at the Midway Island battle. The upper and lower gun turrets and the careful streamlining of the 1,700 h.p. Wright Double Row Cyclone engine are emphasised. Totally enclosed between the lower rear turret and the engine, a 21in. torpedo is housed. Another picture appears on page 114.



A Daimler-Benz-engined Macchi 202 fighter which was shot down by a South African Brigade in the Western Desert.

The German Strategy

THIS battle for Egypt and the German push towards Rostov are part of the same strategic movement on the part of the Germans, which aims at getting to the oil of the Caucasus and all the other benefits which would follow from cutting the Allies in two in the Middle East. The two Allied Generals, Auchinleck and Timoshenko, have fought the opening

ENEMY AIR LOSSES TO JULY 25th.

		Over G.B.	Over Continent	Middle East
July	19	0	1	5
"	20	0	0	3
"	21	1	0	6
"	22	1	0	4
"	23	7	2	9
"	24	0	0	13
"	25	5	2	4
		14	5	44

Totals: West, 6,073; Middle East, over 4,360.

rounds with great skill, realising that no one patch of ground, not even industrial Russian cities, is so important as the intergrity of their respective armies.

The Pacific War

THE war in the Pacific has shown signs of growing lively again. A Japanese force has landed at a place called Gona, on the northern coast of New Guinea, and their aircraft have made raids on Port Moresby, Darwin, and Townsville. The last-named place is the second largest city in Queensland, and the raid seemed to bring the war home to the States in the south-east of the Commonwealth. However, the raid, which is supposed to have been made by flying boats, did no harm and caused no casualties.

The Australians and Americans have reacted fiercely, and their bombers have attacked the Japanese at Gona, where troops, barges and stores just landed provided plenty of targets. Dive-bombers of the type Douglas A24 were used in these attacks.

The Germans in the West continue to make minor raids on Great Britain, and sometimes they blossom out into

WAR IN THE AIR

sorties by as many as 40 bombers in a night. This is rather a contrast to the full-throated blitz of 18 months ago. One night last week a good proportion of the 40 got into the Midlands and did some damage, but as they lost seven of their machines that night the Germans cannot have felt very well satisfied with the result.

Bomber Command, for its part, has made some more daylight raids on the Ruhr, helped by the cloudy weather which has been prevalent. The heavy raid on Duisberg mentioned above was followed up by further visits to the same place, in which both four-engined and twin-engined bombers took part. More bombs of the 4,000 lb. category were dropped (on one of the subsequent raids 50 of them were dis-

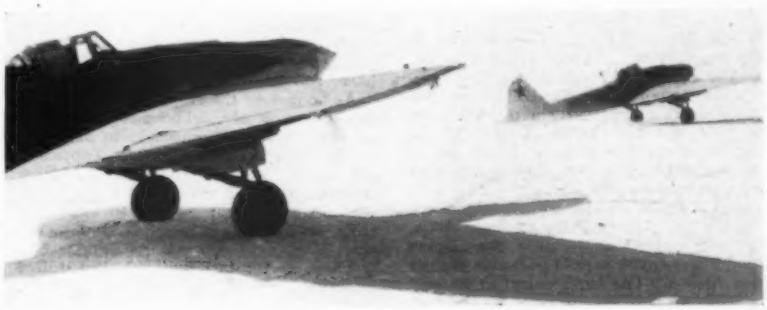
BRITISH AIR LOSSES TO JULY 25th.

		Over G.B. A'crft.	Over Continent B'brs.	Over Continent F'trs.	Middle East A'crft.
July	19	0	5	1	1
"	20	0	0	1	6
"	21	0	14	3	6
"	22	0	1	2	9
"	23	0	7	7	5
"	24	0	1	2	13
"	25	0	14	5	3
		0	42	21	43 (11 pilots safe)

Totals: West, 4,200; Middle East, about 1,500.

charged) and the crews of the daylight raiders over the Ruhr saw the smoke of the fires still burning.

Fighter sweeps have also continued, and during last week some American Army fighters took part for the first time. Our Spitfires have been holding their own well against the formidable Fw190, which is now the best German fighter, and which is appearing in ever-increasing numbers.



JET PROPULSION. Russian Stormovik IL2 rocket bombers about to take off. The bombs, which can be seen in the wing racks, are given extra propulsion by a rocket in the tail. Penetration and a flat trajectory in a low-level attack is the object of this scheme.

NEW ROTOL AIRSCREW

Fully Feathering Type Designed for Trainer Use

THE complicated cockpits of modern Service aircraft have led to the necessity of teaching pupil pilots "cockpit drill" in order that the proper sequence of operations should be attended to as second nature.

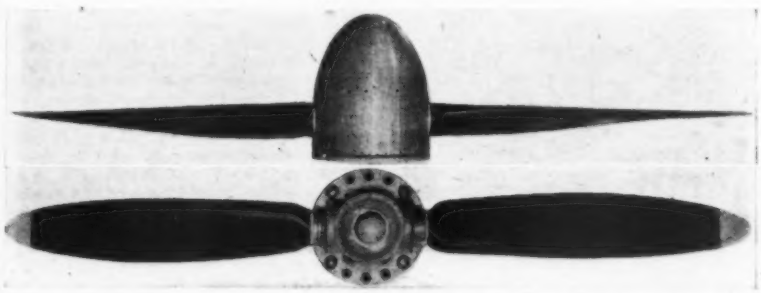
At the operational training units, for example, a trainee goes through this cockpit drill on a jacked-up aircraft until he can, literally, go through it blindfolded. The need for this drill is emphasised when it is remembered that even on a simple single-seat fighter like the Curtiss Tomahawk, there are no fewer than 35 separate items in the cockpit drill.

In the training aircraft such as the Oxford and Anson some of this cockpit drill has until now been make-believe. In particular the controls for variable pitch airscrews were fitted, but the airscrews themselves were of the fixed-pitch type. There has been obvious drawbacks to this system, because a control that does nothing is likely to be disregarded.

This shortcoming in our trainers will shortly be remedied as it is now announced that the Rotol Company has produced an hydraulically operated, two-bladed, constant-speed, fully-feathering airscrew for trainer aircraft. It weighs only 110 lb.

Not only will the pupil pilots no longer go through the feathering drill with dummy controls, but they will actually be able to master the technique of flying multi-engined aircraft with one engine stopped and the airscrew feathered. This is vastly different from handling a machine with one engine throttled back.

The new airscrew will be fitted with easily reparable wooden blades to make up for the high mortality rate in airscrews inseparable from training machines. A further advantage of wooden blades is that in breaking they rarely damage the hub.



The new Rotol two-bladed, constant speed, fully-feathering airscrew has Jablo wooden blades.

HERE AND THERE

Electric Aircraft Engine Warmer

FOR safely thawing out and quickly warming up cold aircraft engines an electric heating device to be attached to the cowling has been designed by Paul F. Hackenthal, of Baltimore, Maryland, to whom a United States patent was issued in June.

The device, as described in the specification, consists of separable matching discs shaped to fit into and seal the cowl opening and to fit closely around the airscrew shaft. Attached to the inside of one disc is an electric heating element wired for connection to a source of electric current.

When the discs are mounted to the cowling, the heater is enclosed between them and the cowl opening is closed so that little heat escapes.

Neutral Enterprise

THE Swiss Federal Government is considering a project for the extension of the Basle Airport. The commercial airport at Bâle-Birsfelden, for many years operated by a private company, "Aviatik Beider Basel" (Aviation of Both Bâles), was found to be unsuitable owing to the expansion of port installations on the Rhine.

A scheme to provide for a new modern airport at Allschiril-Burgfelden, Bâle, did not materialise because the airport would necessarily spread over the frontier into Alsace. The new project at present under consideration provides for the construction of an up-to-date airport at Hard at a cost of four and a quarter million Swiss francs.

It is expected to be completed by 1944.

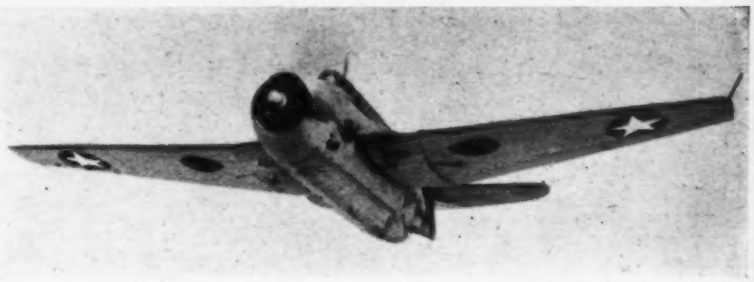
Very Fully Feathered!

A FREAK stroke of luck, when one of the propellers flew off just as the pilot was preparing to "ditch" in the sea, saved a Coastal Command aircraft from destruction and enabled the pilot to bring the aircraft safely home.

On his first operational flight a young pilot officer of a Blenheim fighter on convoy escort found his starboard engine oil pressure dropping, and set course for base, 200 miles away.

As he nursed the engine, losing height, it cut completely. The pilot jettisoned all extra load and managed to maintain height a few feet above water. Approaching land, however, the pilot officer thought it would not be possible to gain the extra altitude needed to clear the cliffs, and prepared to crash land in the sea.

Then, at the last moment, the stalled engine's propeller flew off and the aircraft climbed easily, landing safely at a nearby airfield.



A three-quarter front view of the Grumman Avenger—America's newest torpedo plane—which shows how its clean lines are obtained by stowing the 21in. torpedo internally.

Trophies for Scottish A.T.C.

KEENNESS among Air Training Corps Cadets in South-East Scotland is stimulated by two trophies, which have been presented for competition among squadrons by Bailie T. Sawers, chairman of the Edinburgh City Wing and of the S.E. Scottish Area, A.T.C.

The trophies will be awarded for the first time to-morrow, July 31st, and thereafter each half year. They will go to the best squadron in each area. The squadron with the largest proportion of cadets who have passed the proficiency test will be regarded as having first claim.

Edinburgh City Wing's trophy is a particularly fine piece of work. It is of bronze, representing an eagle on a rock, with wings outspread as though taking off in flight. For the South-East Area there is a silver cup.

The two trophies will be presented to the winning squadrons by Group Captain the Duke of Hamilton and Brand, A.T.C. Commandant for Scotland.

Wearing o' the Kilt

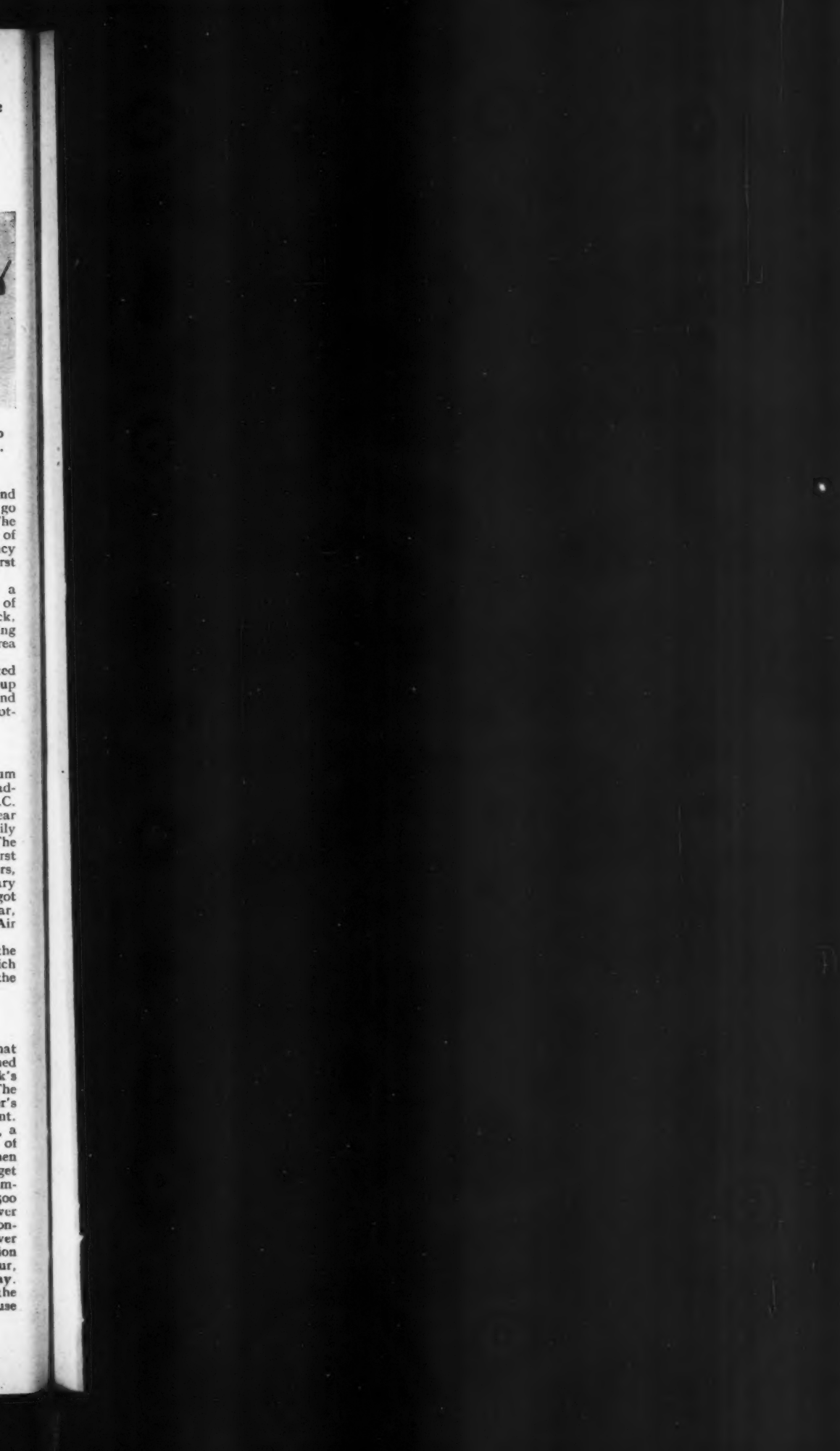
INCIDENTALLY, the pipe and drum band of the City of Edinburgh Squadron is one of the few Scottish A.T.C. units that sport the kilt. They wear the grey Douglas tartan, the family tartan of the Duke of Hamilton. The privilege of wearing this tartan was first accorded to the squadron's big brothers, No. 603 (City of Edinburgh) Auxiliary Air Force Squadron. The cadets got their kilts in the days before the war, when they were a unit of the old Air Defence Cadet Corps.

Another A.T.C. pipe band wearing the kilt is that of Peebles Squadron, which has permission to wear the tartan of the Duke of Buccleuch.

Aircraft models predominated in an Arts and Crafts Exhibition arranged by General Aircraft, Ltd., for the benefit of their employees. The exhibits (of which the above is but a corner), revealed unmistakably the painstaking effort and skill applied to more vital engines of war.

Slide-rule Slip

READERS must have been somewhat puzzled by the arithmetic contained in the Outlook paragraph in last week's issue entitled "Fuel Conservation." The editorial slide rule (or rather the Editor's reading thereof) slipped a decimal point. To make confusion worse confounded, a misprint gave the average power of engines on test as 50 h.p., when 1,000 h.p. had been intended. To get matters straightened out, let us summarise the whole argument: If 500 engines are on test at an average power of 1,000 h.p. each, and the average consumption is one-half pint per horse-power per hour, the total hourly consumption is in the region of 30,000 gallons per hour, or 360,000 gallons per 12-hour day. Truly sufficient reason for adopting the suggestion of our Managing Editor to use this power for generating electricity.



STEAM IN THE AIR

Early Attempts to Use Steam Power in Aircraft

Progress During the Past 20 Years Reviewed

The "Avion"—a bat-shaped aircraft designed by Ader.

By V. L. GRUBERG

SINCE the very early days of flying the problem of aircraft propulsion has been in the forefront of researches. In the pioneering days the absence of other power prompted the development of steam propulsion. It was natural that with the experience already available with steam engines, designers of aircraft turned to steam in their search for some suitable source of propulsion.

The problem of finding a suitable "propelling apparatus" preoccupied the researches of Sir G. Cayley. Cayley realised, however, that the primitive steam engine as available then was too heavy. He was rather more hopeful of the experiments of Chapman, a Newcastle man, who experimented with a machine in which hot air moved the pistons.

Inspired by the work of Sir George Cayley, William S. Henson conceived (1843) the idea of a steam-driven aircraft, which was to be flown across the Channel and further to Egypt and India. In co-operation with his friend, Stringfellow, a model was constructed which, while not unsound in the design, was lacking a scientific basis. And after five years of efforts and expensive experiments Henson gave up and left England for the States. At the beginning of this century Clement Ader constructed, with the financial help of the French War Minister, a steam-driven aircraft, and it was claimed that on October 14th, 1897, he actually succeeded in leaving the ground in his "Avion." The aircraft was damaged in a subsequent test, and is now in the Paris "Musée des Arts et des Métiers."

While the above and other experiments belong to the prehistoric period of steam power development, they have laid the foundations for far-reaching improvements since achieved in the design of steam plants for the propulsion of aircraft.

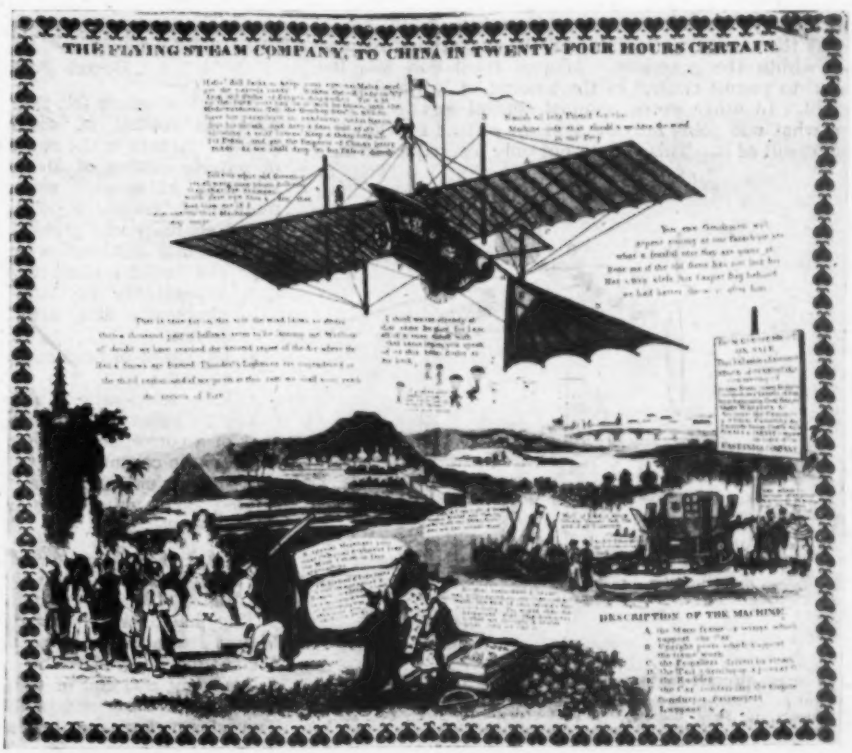
In more recent times, steam propulsion has retreated in face of the victorious march of the internal combustion engine. Nevertheless, considerable progress has been achieved in the design of steam power plants, and the search for power units suitable for the propulsion of aircraft continued. A description of a few typical examples of this development, which is given below, may serve to illustrate what has been achieved in this line of technical endeavour.

Later Developments

Bureau of Engineering (U.S. Navy Department) Steam Propelling Plant.

The plant was developed soon after the last war and considerable experiments were made with it since it showed a certain amount of promise.

The particular form which this generator took was largely dictated by the fact that fire brick or other refractory lining for the combustion chamber could not be used on account of its weight. The combustion chamber was therefore enclosed within walls of steel tubing through which the steam generated in the heating coils passed and became super-heated. In order to conserve the heat radiated from these walls, an air jacket surrounded the entire boiler and air was drawn through this jacket by a fan blower and delivered to the combustion chamber.



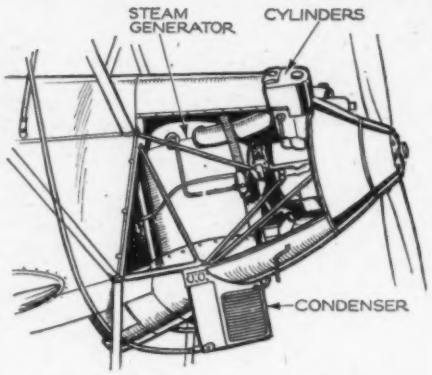
Henson's steam-powered aircraft which was to fly to "China in twenty-four hours certain."

D

STEAM IN THE AIR

A light steel casing enclosed the tubing in order to prevent hot gases in the combustion chamber from entering the air jacket, and the latter had an outer wall of thin sheet aluminium between which and the inner wall was a space of four inches through which the air passed. This method of heat insulation proved exceedingly effective and little heat was radiated to the atmosphere.

In the ultimate design, it was accepted that a fuel pump would be included in the same housing with the water feed pump, and both pumps together with the fan blower would be driven by a turbine mounted on the pump housing so that the plant as a whole would be self-contained.



A steam power plant for aircraft designed by Besler.

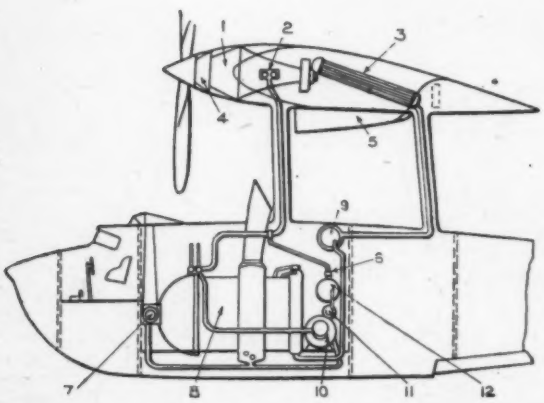
The boiler proved to be a very efficient and flexible steam generator. It was designed to evaporate 9,000 lb. of water per hour at 300 to 500 lb. pressure, and at a temperature of 800 to 900 deg. F. It proved to be capable of evaporating much more water than this and to maintain an efficiency of 80 per cent. under these full load conditions. On one test with a throttle pressure of 325 lb. gauge and a throttle temperature of 772 deg. F., burning 1.2 lb. of oil per sq. ft. of heating surface, it evaporated 9,450 lb. of water per hour, with an 80 per cent. efficiency. The capacity of the water pump was reached at this flow and this prevented ascertaining the maximum capacity for evaporation of the boiler.

Unusual Control System

A type of throttle was adopted which was so arranged that whatever might be the rate of steam produced up to full capacity, the throttle allowed its outflow to the engine but at the same time maintained the predetermined pressure within the generator. Manual regulation was furnished to permit control of the amount of fuel and water at will. In other words, manual control was to be only over what was going into the system, instead of what was coming out of it. This system not only insured a constant steam pressure under all rates of steaming, but also dispensed with the necessity of a blow-off safety valve.

For the tests kerosene was used as a fuel and there is, of course, a wide difference, as the American report pointed out, between the use of a volatile fuel and that of a fuel which has to be sprayed under pressure and to which air must be supplied under forced draught from a blower.

As a result of experiments, a generator was developed from which it was estimated that the finished weight of the generator, including pumps, fans and all other auxiliaries, could be reduced below 2,000 lb., which would give a generator weight of less than 2 lb./h.p. It was felt that a generator had been developed with high thermal efficiency as compared with other boilers, which could, if further developed, have a capacity for producing steam at any desired rate of superheat and which had large steaming capacity per unit of weight and space occupied, adequate steadiness of steaming rate under fixed conditions, and adequate heat insulation without the use of fire brick or refractory lining. It was safe from disastrous explosions without the use of a blow-off safety valve; it gave excellent automatic distribution of water through the heating coils, thus preventing overheating of any coil; it had an efficient automatic throttle system maintaining constant pressure without regard to sudden changes in the demand for steam with the engine; and it had an efficient and easy method of controlling manually the rate of combustion and corresponding water supply. It was also capable of raising steam quickly from cold water, and would be free from scaling or cracking.



The steam aircraft engine of the Great Lakes Aircraft Corp.:
(1) Turbine, (2) Valves, (3) Condenser, (4) Gearing, (5) Air Scoop, (6) Ejector, (7) Blower, (8) Steam Collector, (9) Feed Water, (10) Steam Generator, (11) Fuel Supply, (12) Collector.

Some Positive Results

The investigators felt that there had not been developed adequate control of steam temperature upon sudden manual changes in the steaming rate, nor was the problem of outside rusting of steel tubing solved. With special reference to aircraft propulsion, the generator had a number of favourable points:—

1. Reliability and probably durability as compared with internal combustion engines.
2. The use of fuel oil in place of gasoline.
3. Adaptability for large powers without increase in complexity and with reduced weight per unit of power.
4. Retention of or possible increase in efficiency at high altitudes.
5. Ease of operation and control.

The anticipated fuel consumption was also about twice that of a corresponding Otto-cycle engine. Tests showed a reduction in consumption to approximately 250 gr. h.p./hr. but such reduction in specific fuel consumption was considered to involve substantial and almost impossible difficulties.

Besler's Steam Power Plant (U.S.A.).

Besler fitted his steam power plant to the "Standard Travelair" biplane 2,000 in Emeryville, Cal. The propelling machinery consisted of a two-cylinder compound V-type steam engine of 90 h.p. The steam generator was a coil-tube boiler fired by oil fuel. The feed water was delivered at one end of the coil by a high-pressure pump and left the other end in the form of superheated steam. The steam left the boiler with 77 atm. pressure at

430 deg. C. The condenser worked at atmospheric pressure. The weight per power-unit was about 4.5 kg./h.p. (whereof 0.95 kg. was the propelling machinery, 1.1 kg. the water-tube boiler, and 2.75 kg. the condenser and the auxiliaries). The airscrew was driven direct by the reciprocating steam engine at 1,350 r.p.m.

A later version embodied a reciprocating steam engine based on the design described above with a weight of 180 lb. The power developed was 150 h.p. at 1,625 r.p.m. supplied with steam at 1,200 lb./sq. in. pressure. The steam generator consisted of a single tube about 500ft. in length, and weighed with accessories 150 lb. Fired by oil fuel it could be heated up to working pressure within 40 to 60 sec. To start the generator it was only necessary to switch on an electrically activated blower, which mixed the air and fuel in the correct proportion and forced it through a special burner into the combustion chamber, where by means of a sparking plug the mixture ignited. From this moment steam pressure and temperature were automatically controlled by a thermostat, and the pilot had merely to regulate output by means of a throttle in the air intake.

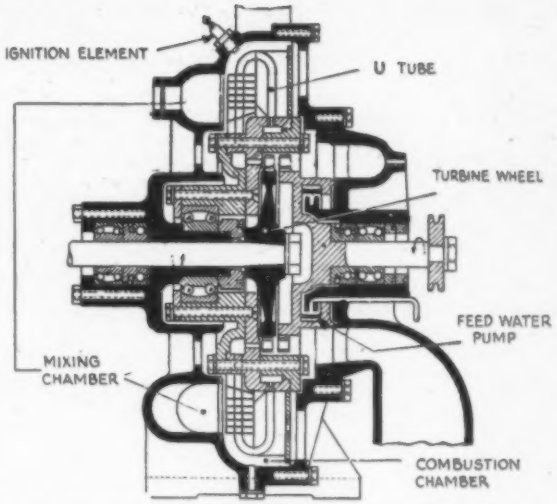
Swiss and American Types

The Sulzer Single Tube Steam Generator, constructed by the Gebr. Sulzer of Winterthur, Switzerland, 1933, was composed of a tube 40 mm. diameter, 1,300 m. length, and worked under pressure of 100 atmospheres. Feed water entered at 150 deg. C. and at 130 atmospheres, and after super-heating left at 400 deg. C. and 100 atmospheres. The pressure drop along the tube ensured active circulation and high heat transfer. Over 7,000 kg. of water were evaporated per hour, giving a steam output of 24 kg./hr./sq. m. of heating surface. (*Stodola.*)

The *Great Lakes Aircraft Corporation of America* collaborated with the General Electric Company in the development of steam-propelling plants intended for installation in large flying boats. The result of this development was a steam power unit of 2,300 h.p. with a La Mout type steam boiler. The main components of the generator were: an air pre-heater, a blower to assist the action of the relative wind, a super-heater, an oil burner and an exhaust manifold. Wet and superheated steam was carried in steel-alloy pipes lining the walls of the generator, arranged axially and forming together a cylindrical-shaped casing. Pipes for oil and water were in light alloy. The boiler was started electrically and produced a maximum of 9.5 tons steam per hour at a temperature of 540 deg. C. and a pressure of 70 atm. The blower for the combustion air was activated by means of electro-motors fed from a storage battery.

The operational altitude of this power plant was 1.5 km., and the specific fuel consumption was reported to be 270 gr./h.p., showing a thermal efficiency of 23 per cent. *Aero Turbines, Ltd.*

Some time in 1938 this firm demonstrated a prime mover, closely resembling the German Huttner turbine, in which the rotary generator, turbine, condenser and starting mechanism were combined in a single unit. The general principle is simple enough: It includes a boiler of the rotary type, with U-tubes having their open ends connected with the water pump and steam passage to the turbine respectively. The turbine is within the same casing, and when the turbine has once been started rotating by a small extraneous electric motor and has generated a certain amount of steam, it is self-driven by the reaction of the steam jets.

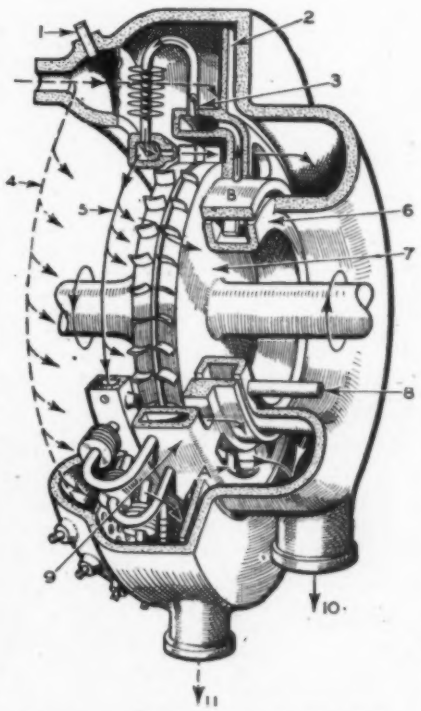


A section through the steam unit of the Aero-Turbines Ltd.

The two rotate in opposite directions, and a small rotary pump feeds the water to the boiler.

Fuel oil of almost any sort can be used, and a combustible mixture is passed through a series of holes in an annular mixing chamber into the combustion chamber, in which it is ignited by an electrically heated wire.

In tests demonstrating the efficiency of the power plant, cold water was fed to the boiler, and in about 65 seconds the steam gauge indicated 25 lb./sq. in. The fuel was turned off and cold water was fed to the boiler with no disastrous results. Then the fuel was turned on and the boiler started again. The particular boiler, it might be mentioned, was capable of an output of approximately 30 h.p.



The steam power plant of Aero Turbines Ltd.: (1) Ignition Plug, (2) Insulating Wall, (3) Atomizer, (4) Path of Flame, (5) Path of Steam, (6) Centrifugal Pump, (7) Reaction Plate, (8) Water Inlet and through A & B, (9) Annular Chamber and U-tubes integral with Reaction Plate and rotating in same direction, (10) Spent Steam to Condenser, (11) Burnt Exhaust Gases.

Boiler Speeds

According to the constructor's report the rotary boiler can be used as a condenser. During the development period a boiler was, according to these reports, run at various speeds up to a peripheral speed of 830 ft./sec. and provided pressures up to a maximum of 150 atmospheres. The maximum heat transmission capacity at maximum velocity was 553,000 B.Th.U./sq. ft./hr. When the same unit was run as a condenser at the same maximum speed, the maximum heat transmission was found to be 203,000 B.Th.U./sq. ft./hr. In a 2,000 h.p. unit the turbine is reported to run at about 10,000 r.p.m. and the boiler at something like half that speed.—Reported fuel consumption, 0.35 lb./b.h.p./hr. Unit weight, 2 lb./h.p.

STEAM IN THE AIR

The Béchard Steam Power Plant (France).

Béchard developed a rotary boiler type consisting of three casings in which a shaft with three discs is made to rotate. The three casings are externally heated and partly filled with water, before starting, which participates in the rotary movement owing to friction against the wheels, during rotation. In operation a constant flow of water is produced, thus eliminating the need for a separate feeder pump. The rotation of the boiler ensures even heating of all parts. In steady running steam generation proceeds (as shown in the diagram) in three stages. Fresh feed-water enters the first casing, is brought into rotation, pre-heated and partly evaporated. In the second casing this evaporation is completed. The third casing serves as a super-heater, and the steam issues through nozzles and is axially deflected in a ring of guide blades.

The effective performance of the turbine, which apparently works with 100 per cent. reaction, is produced by the reactive shock of the steam issuing from the nozzles. According to details communicated by Béchard in January, 1938, tests with his No. 5 steam power plant produced the following results:—

150 kg. of dry steam at a pressure of 4.5 kg. The consumption of residual oil fuel was 13.5 kg., showing an efficiency of 0.6, at a speed of 950 revolutions.

In another test Béchard obtained a speed of 1,200 revolutions. These results have been achieved with a machine of a total heating surface of 0.96 sq.m. and without reheating the water.

Relying on his experience, Béchard maintained that there should be no difficulty in producing a plant operating at 1,800 r.p.m. with a steam output of 200 kg./sq.m./hr. at an atmospheric pressure of 30 to 35 kg., superheated to 500 deg. C. and with a boiler efficiency of 90 per cent.

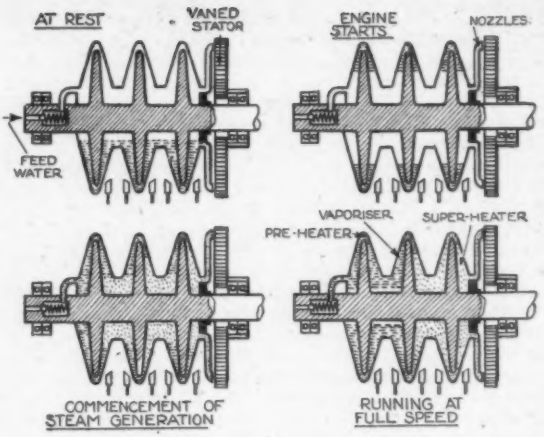
Problems and Possibilities

In order to appreciate correctly the possibilities of the employment of steam power for the propulsion of aircraft, one has to bear in mind, first of all, the inherent requirements of such power plants. Broadly speaking, they can be summarised as follows:—

(a) Light weight (low weight per unit power).
(b) Reliability in service.
(c) Economy (high thermal efficiency).
(d) Durability.
(e) Compactness (less drag).
(f) Flexibility.
(g) Good behaviour at high altitudes.

The report on the investigation on steam propulsion for aircraft published by the American National Advisory Committee on Aeronautics concluded that "on the basis of the weight of the power plant alone steam power plants for aircraft are precluded. On the basis of economy alone, they are again precluded. On the basis of the resistance of the cooling surface required alone, they are precluded. On the basis of the sum of these three considerations they are absolutely impossible."

While this verdict, pronounced by such eminent experts, appears to wipe out any further possibilities for steam power propulsion, it should not be taken as final. The trend of aircraft design which calls for more powerful power units opens, perhaps, new vistas for the employment of steam. Large flying boats, some recently designed and some already on construction, necessitate power plants which in power output and size surpass everything hitherto known. The American Martin XPB2M-1 "Mars," the French Potez-SCAN161 and the Latecoere 631 are somewhere in the region of 65 tons or more. The Breguet Company is engaged on projects of flying boats of a weight of 75, 250 and even 950 tons, with twin decks in the wings. Such large size aircraft will permit, perhaps, the employment of steam propulsion if the necessary improvements are made and existing drawbacks are abolished.



The diagram shows the stages of operation of the Bechard steam aircraft engine.

In the view of different experts a successful development of steam propulsion will embody the following features:—The unit weight of steam plants will have to be considerably reduced. This is possible if the durability of the steam plant is reduced to that of internal combustion aircraft engines. Two-stage turbines will make it possible to make use of the entire available gradient between the working pressure of 100-200 atmospheres and the exhaust back pressure of 0.4 atmospheres. A low specific fuel consumption is necessary which in mercury-vapour plants has already attained 170 g./h.p./hr.

Such improvements already challenge Diesel installations. While the flexibility of steam power plants is as yet far behind that of internal combustion engines, a further progress in this direction is possible. Moreover, since they may be mainly destined for larger types of aircraft, it is not necessary to achieve that high flexibility which is required for fighter aircraft.

The necessity of regulation and maintaining a substantial power output at any altitude is evident. A suggestion to supercharge the boiler as a whole and, similar to the practice adopted for supercharged internal combustion engines, expand the combustion gases issuing from the boiler in an exhaust turbine, thus recovering the power required to operate the boiler-supercharging blower, appears to go a long way towards improvement. Air heaters utilising the waste heat can also be coupled in series behind the boiler, and their exhaust further used in reaction nozzles to produce supplementary thrust. (*Knoernschild*).

Finally, there is the problem of compactness. This is an important factor not only from the weight aspect but also because compactness is an important factor in aircraft design. Here the main problem of a suitable condenser so designed and placed as to produce a minimum of drag is urgent. While American experiments tried to solve it by a "wing radiator" it was suggested (*Meredith*) that completely enclosed condensers with forced draught are preferable. It was further suggested that in such arrangement and with a suitably adapted cooling-air intake and discharge orifices, a portion of the condenser heat could be turned to produce extra thrust.

While it is not attempted here to advocate the employment of steam propulsion for aircraft or to indulge in predictions, it should be realised that considerable progress has been achieved in this direction. During the past two decades the internal combustion engine has acquired a monopoly in the propulsion of aircraft. Experiments and researches with steam propulsion shown briefly in this summary were rather limited to single efforts without that mighty impetus which is derived from production on a larger scale. The results in steam power development achieved despite such handicaps seem to point out that this development has not reached its final stage.

BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Honours for Dornier

CLAUDIUS DORNIER, founder and managing director of the Dornier Aircraft Works, has been elevated by Hitler's order to the rank of Professor.

Ladies for Regia

ABOUT 700 women, members of the Fascist Party, have been recruited for service with the Italian Air Force. One hundred of them are reported to be engaged in wireless communications from airfields, while the rest are undergoing training as ground wireless operators.

Hispano Suiza

AT their works in Bois-Colombes, near Paris, and at Tarbes, in Unoccupied France, this firm has completed the development of a new 12-cylinder liquid-cooled engine, designated 12Z. The new type differs from the 12Y by the doubling of its valves, and its power output is about 1,400 h.p. It is reported, however, that this will soon be brought up to 1,600 h.p.

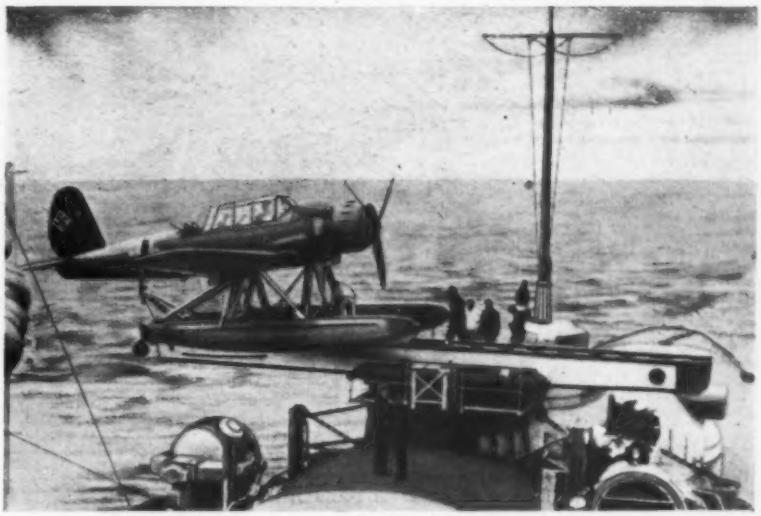
The development of a 24-cylinder type demonstrated at the Paris Aircraft Show of 1938 continues under the direction of M. Birkigt. The four 6-cylinder banks in an "H" arrangement and driving two crankshafts are now to be replaced by those of the new 12Z. The new 24 H engine is to have a power output of about 3,000 h.p. A further report suggests that the company is planning the development of a high-performance engine, composed of two tandem arranged 24 H types and developing 6,000 h.p.

V.G.50

THE Vichy Government Aircraft Works at Lyons-Villeurbanne are engaged on the construction of a twin-engine all-metal high-speed aircraft, "V.G.50." The designers are Vernisse and Galtier, who for many years were engaged on the design of wooden aircraft. Of particular interest is the power plant arrangement, which is composed of two Hispano Suiza 12Z engines of about 1,500 take-off h.p. and which drive contra-rotating airscrews. One engine is mounted in front of the pilot's cockpit, the other in its rear and below it. The extension shaft of the rear engine passes between the legs of the pilot and contains also the pressure oil lines for the operation of the c.p. airscrew.

Two prototypes are now in construction, one with a conventional, the other with a nose-wheel landing gear. The gross weight of the aircraft is about 16,500 lb., wing loading about 41 lb./sq. ft., and wing area between 365 sq. ft. and 387 sq. ft.

It is reported that the designs for a four-engined Atlantic flying boat have been completed by the same firm. The flying boat is to have engines mounted in tandem. (According to "Interavia" a similar arrangement is to be found on the Heinkel He 177.) The aircraft is to be fitted with a pressure cabin; its gross weight is to be about 27 metric tons, span about 138ft., and its speed 310 m.p.h. at 29,500ft.



An Arado Ar 196 two-seater reconnaissance aircraft on the retracted catapult of a German cruiser The Ar 196 is powered with a Bramo Fafnir 323 air-cooled radial of 830 h.p. It will be remembered that they were employed by the *Bismarck* during its historic engagement with the Royal Navy.

The Italian Caproni Reggiane 2001 single-seater fighter. It is powered by a Mercedes-Benz DB601N engine of 1,150 h.p. and has a maximum speed of 348 m.p.h. at 22,000 ft.

Nazi Munition Council

FLIGHT, July 9th ("Behind the Lines"), reported the formation of a German Munition Council. As mentioned then, this Council is to co-ordinate military and production requirements. In addition to the military members mentioned in our previous report, the following representatives of the industry have been called by Professor A. Speer, Nazi Munition Minister, to serve on the Council: H. Bucher, managing director of the A.E.G.; P. H. Kessler, chairman of the Bergmann Electrical Works and former director of the Siemens firm, well known for his experience in Japan; P. Pleiger, chairman of the Iron Mining and Smelting Section of the Hermann Goering Works; Dr. E. Poensgen, chairman and managing director of the Vereinigte Stahlwerke (United Steel Works); W. Zangen, chairman and managing director of the Mannesmann Tube Works; H. Roehnert, chairman and man. director of the Rheinmetall-Borsig and chairman of the holding company of the H. Goering Works; Dr. A. Voegler, president of the Kaiser Wilhelm Society.

The above representatives of the munition industry are known as "Leaders of Economy" (Wirtschaftsfuehrer).

In addition to this Council, a number of central industrial committees has been formed for the different branches of war production. These committees are composed of engineers and production experts who work in close contact with technical branches of the armed forces and have full authority over the mass production of different war equipment.

A Republic Thunderbolt (P47) just after starting up. The lead from the battery, seen on the left, has just been detached and the cowling cover is being replaced. A bottle of CO_2 is in the foreground in case of fire.

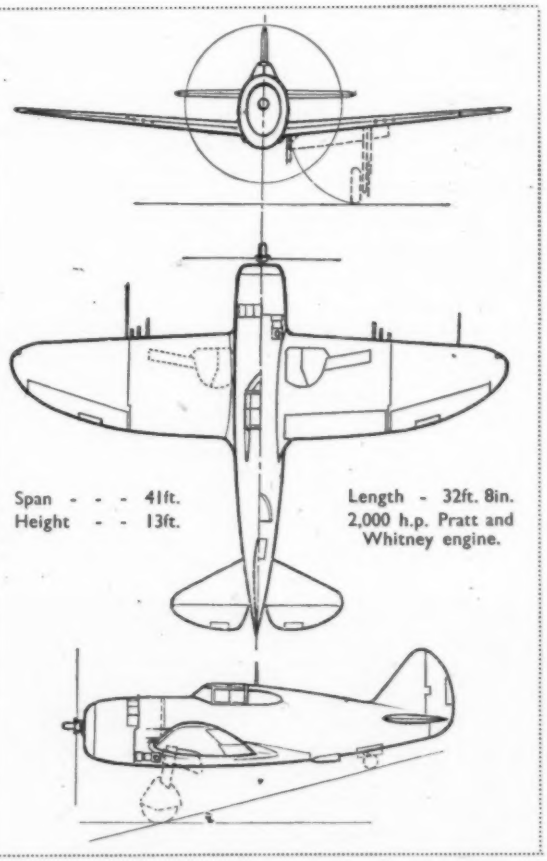
AMERICA'S FASTEST FIGHTER

Some Particulars of the Republic Thunderbolt

THE Republic Thunderbolt is the American interpretation of the single-engined 2,000-plus h.p. 400 m.p.h. fighter. None of the United States liquid-cooled engines of sufficient horse-power is in production, so the choice of motive power has fallen on the Pratt and Whitney Double-Wasp, which has the necessary output. In common with what is fast becoming standard American practice, an exhaust-driven turbo supercharger is fitted to maintain power output at the great heights at which operational flights may now be carried out. A 12ft. four-bladed fully feathering airscrew is fitted to keep down airscrew diameter which, in its turn, affects length of undercarriage leg, and this in turn affecting the disposition of the armament, undercarriage retraction and fuel storage in the wing and body.

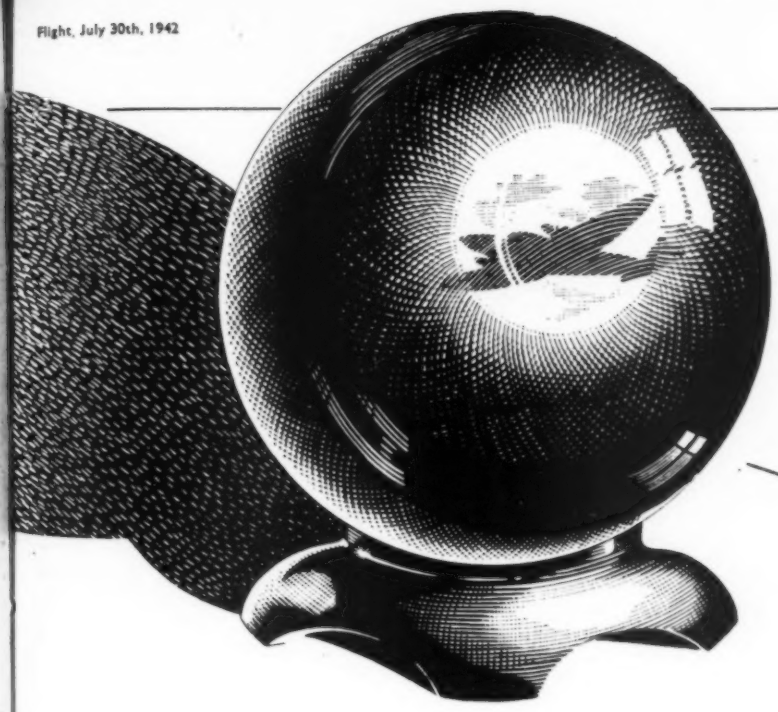
No official pronouncement has been made as to the offensive armament which will be carried, and it is of little use to speculate these days when the rest of the world is trying to learn the lesson which the R.A.F. taught first of all with their 8-gun Hurricanes and Spitfires. Nevertheless, despite the American love of the 0.5in. machine gun, and the variety of ammunition which can be employed for this calibre, it is to be expected that at least two shell-firing cannons will be included in the armament before operational flying is attempted.

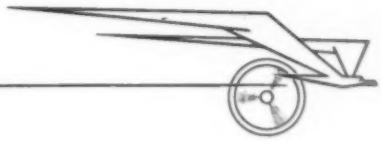
A maximum speed of over 400 m.p.h. is claimed for the Thunderbolt—which brings it into line with the latest superfighters of the belligerents—but no official figure is available. It is also claimed that a speed of 680 m.p.h. has been attained in diving tests. This is only 70 m.p.h. short of the speed of sound.



A *Flight* copyright general arrangement drawing showing the upper side on the port and the under side on the starboard.

In this machine America claims to have the fastest fighter in the world; in the Focke-Wulf Fw.190 the Germans think they have "der schnellste Jager der Welt," but, on the other hand, it *is* possible that they are both wrong.





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AIRCRAFT TYPES AND H

Martin Baltimore and Marauder

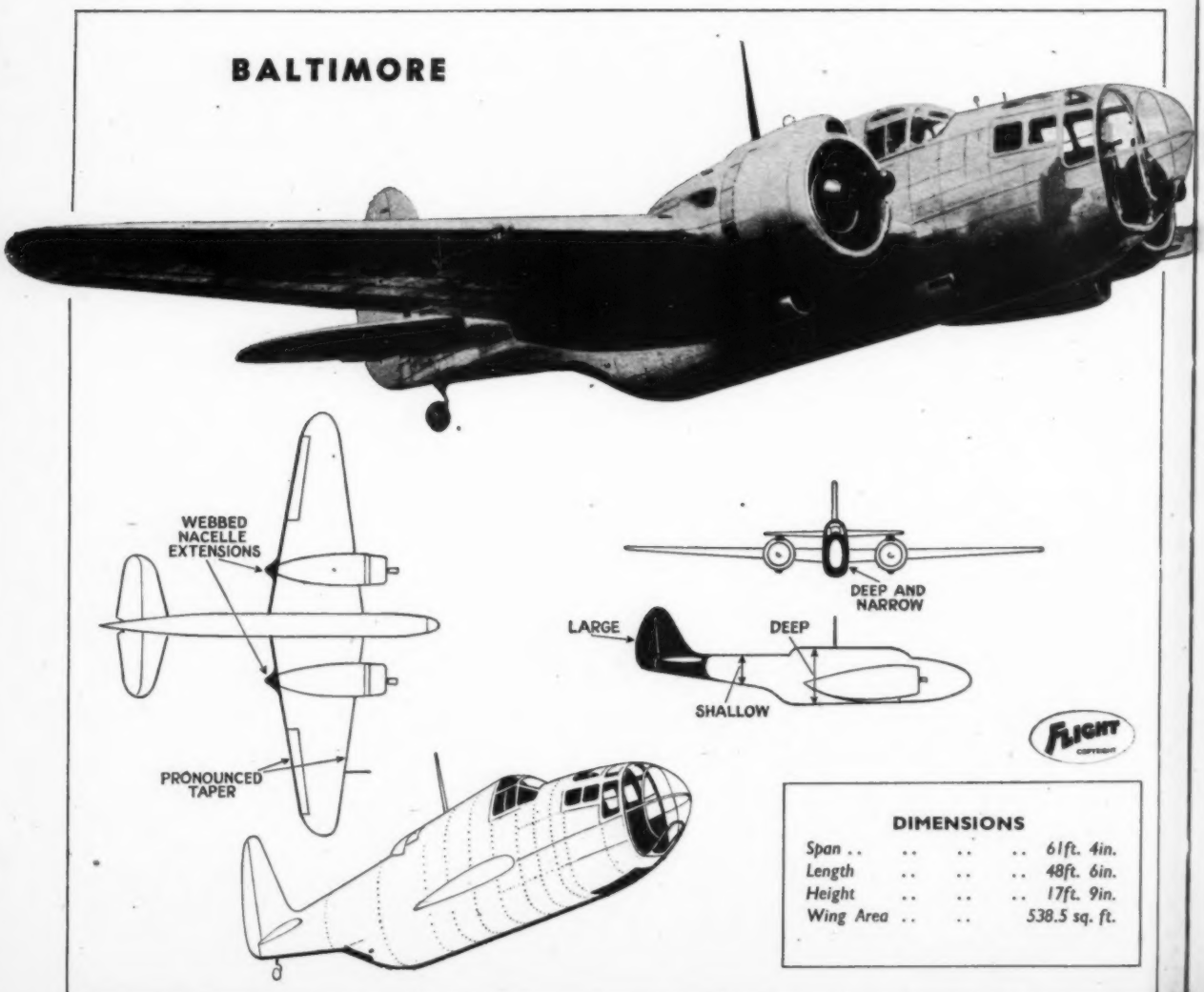
ONE of the oldest aircraft firms in America, the Glenn L. Martin Company, of Baltimore, Maryland, has naturally taken a prominent part in supplying modern bombers to both the U.S. Army and the R.A.F., and the Baltimore (Martin 187) is a development of the Maryland (Martin 167), which has for some considerable time been giving such valuable services with the R.A.F. in the Middle East.

Powered by two Wright 14-cylinder, two-row GR-2600 Cyclone engines of 1,600 h.p., the Baltimore was designed expressly to the requirements of the R.A.F., doubtless as a result of the valuable experience gained with the Maryland. Versatility is claimed to be the keynote, its duties as a medium bomber being combined with those of long-range reconnaissance, while it is quite within the bounds of possibility that it might be used as a fighter-bomber, for, although no information has yet been released for publication as to its performance, it is believed to be one of the fastest twin-engined aircraft of its type, and is equipped with heavy offensive and defensive armament.

Constructionally it follows modern practice, being all-metal with stressed-skin flush-riveted covering except for the control surfaces, which are fabric covered. The fuselage is a semi-monocoque structure in light alloy and the plastic nose, which provides an excellent view for the bomb-aimer, is a particularly interesting piece of work inasmuch as even the supporting framework is of plastic material. The wings also are in three sections, the centre section being built integral with the main section of the fuselage and carrying the engine nacelles. The outer wing panels have two main spars joined by corrugated sheets which form reinforcements for the upper and lower surfaces.

Normal type undercarriage is employed, the main wheels being carried on single, straight, oleo-pneumatic shock-absorbers and retracting backwards. When retracted they are completely faired by hinged doors, but the originally retracting tailwheel has been replaced by a fixed type on the service edition for the R.A.F.

Four fixed machine guns, operated by the pilot, are mounted in each wing, a dorsal turret mounts twin machine guns, and there is another gun, manually operated, which fires through the sliding entrance panels in the floor of the fuselage aft of the trailing-edge. The bomb load varies from 1,000 lb. to 2,000 lb., according to requirements.

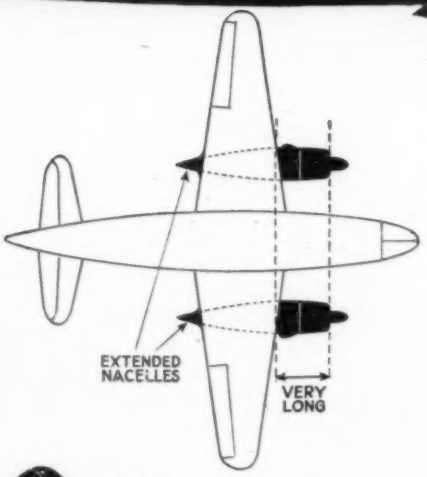


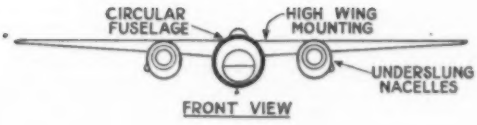
DIMENSIONS

Span	*61ft. 4in.*
Length	*48ft. 6in.*
Height	*17ft. 9in.*
Wing Area	*538.5 sq. ft.*

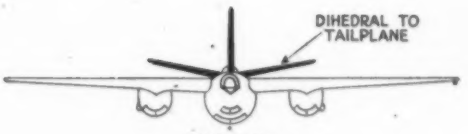
HEIR CHARACTERISTICS

MARAUDER

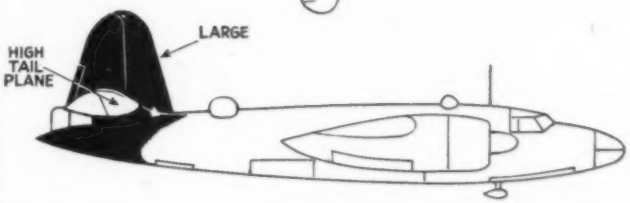




FRONT VIEW



REAR VIEW



DIMENSIONS

Span	65ft. 0in.
Length	58ft. 3in.
Height	19ft. 0in.
Gross Weight ..	26,625 lb.

FLIGHT COPYRIGHT

CERTAINLY one of the most perfectly streamlined aircraft in existence to-day, the Martin Marauder (B-26), was actually designed before the not-quite-so-modern looking Baltimore, and although no performance figures are at present available, a top speed well in excess of 300 m.p.h. has been quoted in America. Probably the difference in the general lines of the Marauder and the Baltimore may be accounted for by the fact that the former is the outcome of a designer's ideal, evolved before that fatal December 7th, whereas the Baltimore's features have been dictated in the hard school of practical experience in warfare.

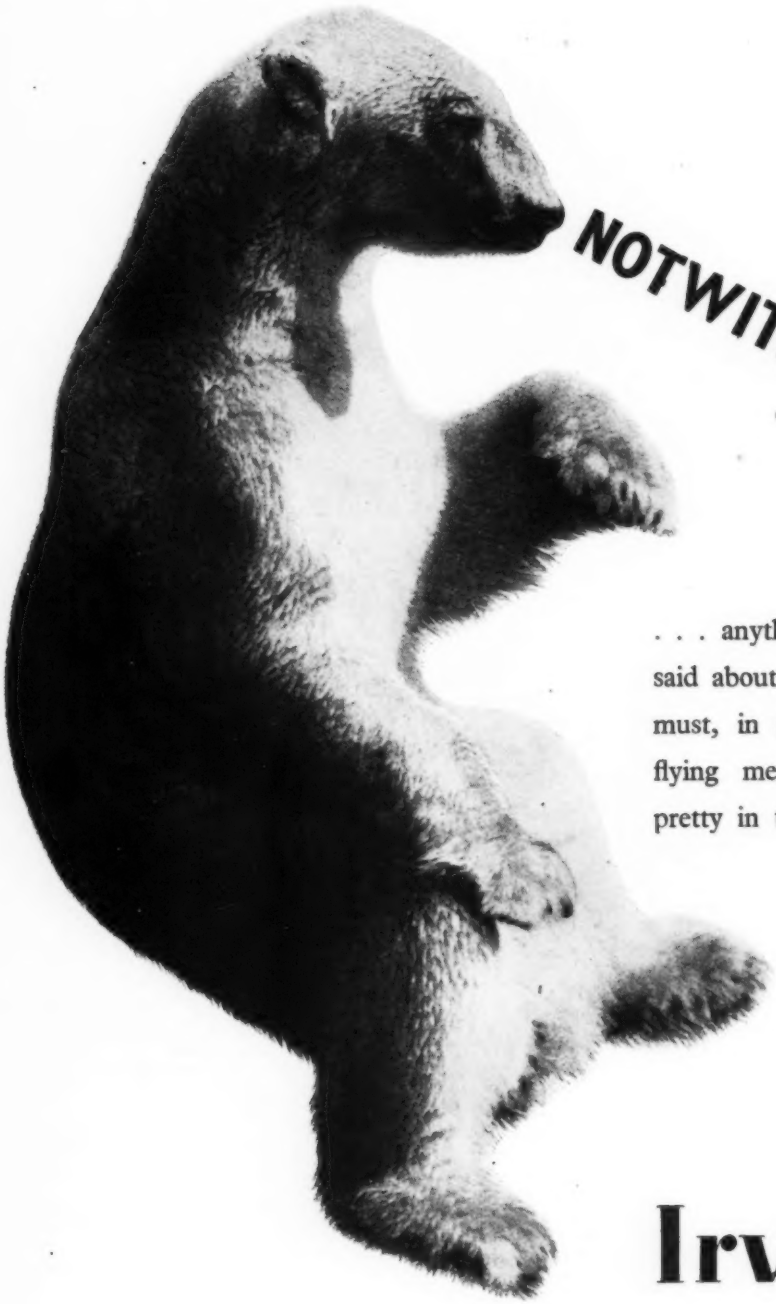
That is not to suggest, of course, that the Marauder has sacrificed the essential factor of serviceability for mere beauty of line, for it is fully expected that, in the hands of both the U.S. Army Air Forces and the R.A.F., it will prove itself to be a fast and powerfully offensive weapon.

In overall dimensions it is slightly larger than the Baltimore, and is powered by two Pratt and Whitney Double-Wasp 18-cylinder engines of 1,850 h.p., which drive the newer type of four-bladed airscrew having sheet metal cuffs on the inner parts of the blades. The function of these cuffs is to make the round parts of the blades a more efficient shape, and thus to force more cooling air into the engine cowling immediately behind them.

Other modern features of the Marauder are its tricycle undercarriage and the moulded plastic nose, which is free of all structural supporting members except for one horizontal one, and is a most efficient aerodynamic shape.

Details of its armament and bomb-load are not released for publication, but it has a "bubble" gun turret above the fuselage aft of amidships and either a gun position or turret in the tail.

Incidentally, the original design as intended for the U.S. Army Air Forces had a gun position in the rear which took the form of a sloping V-shaped transparency through which it was apparently intended to mount a single flexibly mounted machine gun or cannon, but the R.A.F. version of the B-26 appears to have been modified here to take a power-operated turret.



NOTWITHSTANDING . . .

. . . anything that may have been said about our arctic conditions, we must, in all fairness, concede that flying men of to-day are sitting pretty in their Irvinsuits.

Irvinsuit

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TORPEDO AIRCRAFT

Comparison of Carrier-borne and Land-based Types

By M. WADDELL

THE article by "Fougueux," in *Flight* of June 11th, 1942, on the value of torpedo aircraft, raises many interesting points. It must be agreed that torpedo attacks from aircraft are of great value, but the writer's argument gained nothing by the statement that "it has been the exception for any enemy convoy or ship to reach Rommel's forces." The more recent vigorous offensive of Rommel's Afrika Corps suggests that the bulk of his supplies have arrived safely, in spite of bombing attacks on his bases and convoys, torpedo attacks by submarine, aircraft and surface vessels, and gunfire from ships and aircraft. There can be little doubt that these operations would have been more successful but for the very large force of fighters concentrated by the *Luftwaffe* at the Mediterranean coastal airfields, and what measure of success was achieved must be credited in large part to the offensive-defence of Malta.

One is forced to the conclusion that, in daylight operations, the predominant factor in this field, as in others, is the fighter, and no amount of wishful arithmetic will carry conviction that enemy supply lines can be dominated without first achieving a good measure of control of the air.

It is possible by turning tons of petrol into gallons, and multiplying by the number of voyages per year, to get astronomical figures for one tanker sunk; and it may be that the morale of U-boat captains is maintained by such calculations concerning the Battle of the Atlantic; but for our part it would seem impossible to differentiate between the value of the bomb attack on the synthetic petrol plant, the cannon attack on railway petrol wagons, the torpedo attack on the tanker, or the air attack on mobile tankers in Libya.

The big question at the moment concerns the functions of torpedo-carrying aircraft, and the type of aircraft most suited to fulfil those functions.

The recent attacks on the *Prince of Wales*, *Repulse*, and the *Scharnhorst* and *Gneisenau*, suggest that successful attacks may be made on capital ships, provided they have little or no fighter protection. This condition is found when the ships are operating without carrier support, are a long way from land, or a long way from friendly airfields. When fighter cover is available, as in the case of the *Scharnhorst* and *Gneisenau*, torpedo attacks become precarious, and only the most efficient aircraft should be used.

Torpedo Size

In the Channel attack on the two German capital ships, it is noteworthy that the losses of the F.A.A. Swordfish were 100 per cent., whereas the shore-based Beauforts suffered less severely. The question arises whether this was due to shortcomings on the part of Swordfish, which are obsolescent, or whether it may be attributed to the natural handicaps of ship-borne aircraft.

Examination of the data for ship-borne torpedo-carriers of all nations shows that no nation has produced a ship-borne torpedo-carrier with a performance to compare favourably with that of shore-based aircraft. The ship-borne aircraft used by the Japanese are, if anything, inferior to our own older types, such as the Swordfish, and much inferior to the Albacore.

The inferiority of carrier-borne aircraft must be attributed to the fact that they *are* carrier-borne, and not to any failure to produce modern types. The specification for this type of aircraft calls for a robust undercarriage, for landing on a moving platform, folding wings, for easy storage and transport in lifts, and special strengthening of the fuselage to take the strains imposed by the arrester gear. All this means additional weight, and, furthermore, the wing loading and landing speed must be kept low, so that the performance of these aircraft leaves much to be desired. It appears inevitable that they will drop farther behind in the race to instal heavier armour and more and better armament.

Suggestions have been made that the 18-in. torpedo is not big enough and should be replaced by the 21-in. or even the 24-in. Supposing for one moment that a large supply of these weapons is available, it is questionable whether aircraft could be designed to operate from our existing carriers when carrying the larger torpedoes, without reducing still further the already poor performance of the aircraft.

Carriers Vulnerable

The aircraft carrier has played a notable part in the war at sea, but it is probable that the losses among this class have been greater in percentage than with any other class of ship, and their size and complexity render replacement difficult. At times almost the entire force of carriers has been under repair, so that the continuous coverage of the South China or other seas, by this means, would appear to be out of the question.

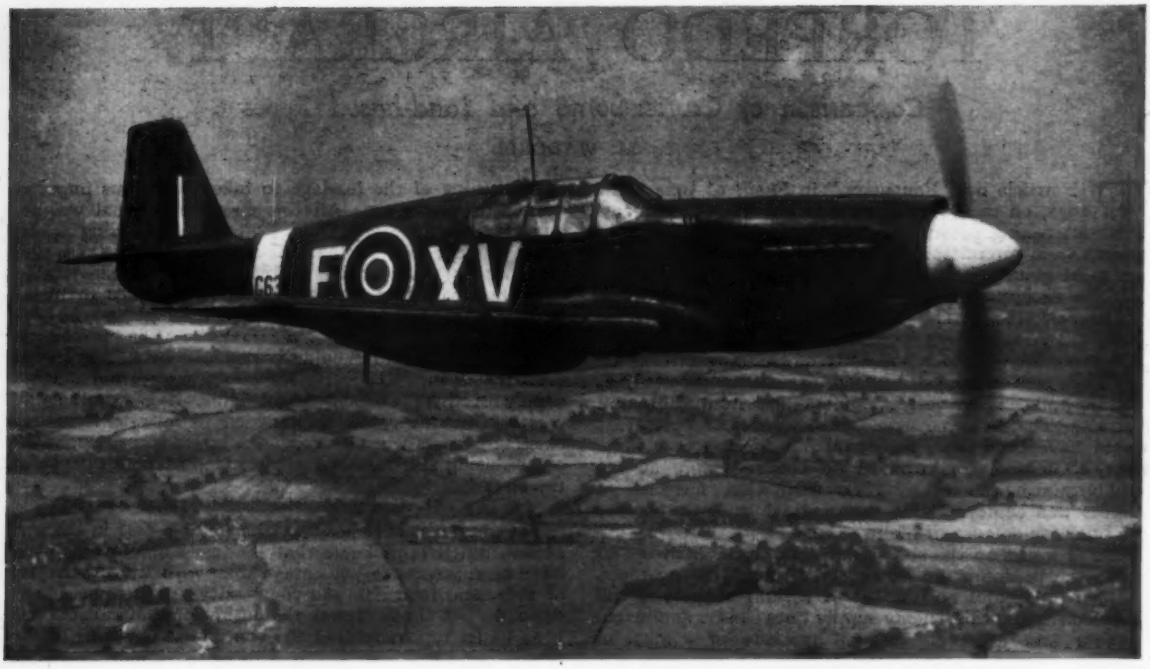
Aircraft carriers are themselves particularly vulnerable to air attack, and their effective sphere of operation must draw farther and farther from land as the range of shore-based aircraft increases.

The most likely form of shore-based torpedo aircraft appears to be a twin-engined monoplane, big enough to carry a 21-in. torpedo, and fitted with long-range tanks and a heavy defensive armament. Efficient air brakes should also be fitted to give rapid reduction in speed when about to drop the torpedo. When heavier cannon become available, it may be found that cannon-fire alone will suffice for the smaller unarmoured vessel, thus leaving the torpedo for attacks on larger ships.

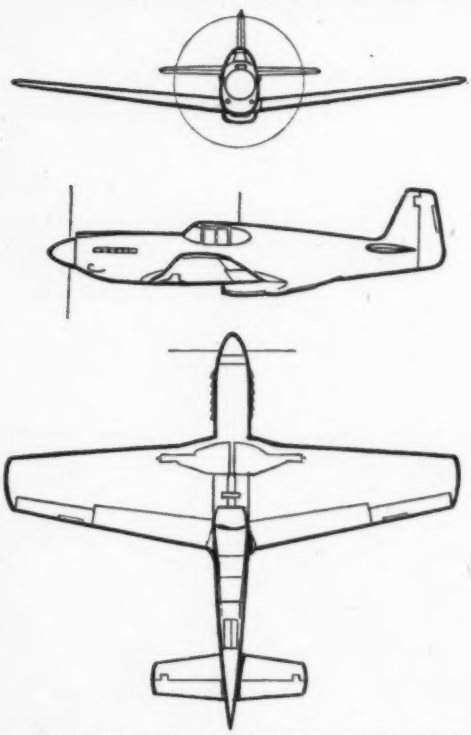
The long distance patrols of Coastal Command Hudson, Catalina, Sunderland and Liberator aircraft, in which thousands of miles are covered and aircraft may be airborne for more than 20 hours at a time, suggest that the time is not far distant when even the largest expanse of ocean may be patrolled, and the patrolling aircraft can call by wireless for a squadron of heavily armed torpedo aircraft to deal with any enemy ships found. As to who should control the shore-based aircraft, the answer must be that aircraft must be controlled by those trained to the air, and ships by those trained to the sea. The argument that, because the quarry is a ship, the attacking aircraft should be controlled by the Navy, is on a par with saying that anti-aircraft cruisers should be controlled by the R.A.F. because they attack aircraft.

The closest possible liaison should be maintained between the sea and air forces, but the ultimate control of other than carrier-borne aircraft should remain in the hands of those trained to its operation. There can be little doubt that some at least of our naval authorities still think in terms of land and water, and fail to realise the potentialities of aircraft.

The absence of an aircraft carrier at the time of the loss of the *Prince of Wales* and the *Repulse* was deplorable, though unavoidable under the existing conditions, but as the ships were within range of shore-based fighter aircraft, and the Japanese attack was expected owing to the ships having been spotted by reconnaissance aircraft, wireless silence was of little value, and it would appear that the failure of the naval authorities to call for fighter support showed a lack of appreciation of the menace of the torpedo aircraft and the need for air defence.



An air view of the North American Mustang. The machine guns in the nose are at the bottom of the cowling and lie along each side of the crankcase.



NORTH AMERICAN MUSTANG (N.A. 73)

WING SPAN: 37ft. 3in. Wing area: 236 sq. ft.
LENGTH: 31ft. 3in.
HEIGHT (at rest): 8ft. 8in.
UNDERCARRIAGE: Wide Track (11ft. 10in.), fully retractable inwards. Tail wheel also retractable.
ENGINE: One liquid-cooled Allison inline, type F.3.R. of 1,150 h.p. with single-stage supercharger.
AIRSCREW: Hamilton 3-blade, constant-speed type.
RADIATOR: Special dual purpose design for both glycol and oil cooling.
SPEED: No details available, but certainly the fastest Army Co-operation aircraft in service anywhere.
ARMAMENT: Two machine guns synchronised to fire through airscrew, two machine guns in each wing.

MUSTANG SQUADRON

Single-seat Fighter Which Has Been Developed for Army Co-operation Work : Oldest Squadron Gets Newest Aircraft

THE other day we visited a squadron which *Flight* first visited 28 years ago—shortly before the 1914-18 war. As an Army co-operation squadron it has a longer history than any other unit.

It is a far cry from the days when its pilots flew B.E.2s —with a top speed of 75 m.p.h.—to the North American (N.A.73) Mustangs which are now its mounts. A glimpse of the advance in speeds and controls since the early days was emphasised when the commanding officer of the squadron, pointed out how docile the Mustang was despite its high speed. He was at great pains to point out that the approach was as low as 90 to 100 m.p.h.—or 25 m.p.h. faster than the top speed of the B.E.

Fighter-reconnaissance

Army co-operation reconnaissance has always been one of the most difficult tasks a Service pilot is called upon to perform. It has been said that at least three years' training is necessary to fit a man for the task. The reason for this is that, while a pilot could not handle a platoon of infantry in the simplest field exercise, he must be able to look down on the battlefield with the eyes of a General. In earlier days, in fact up to just recently, high speed was not considered a necessary qualification of an Army co-operation machine, and in a battle the fighters of both sides considered these slow machines and their highly trained crews rather easy meat.

This is all changed now. To-day the A.C. pilot has to

The Commanding Officer of the squadron briefing aircrews at the mobile field headquarters. On the wing commander's right is the Army liaison officer.

do all the things his predecessor did, but at several times the speed, and almost at ground level. If attacked, these fighter-reconnaissance machines can give a good account of themselves, for they have two machine guns in the fuselage and a further two guns in each wing. Despite this combination of hitting power and speed, the Army co-operation pilots' job is, first and foremost, to get information, and get that information back to field headquarters.

Reconnaissance is, of course, the main job of the Army co-operation squadrons, but there are times when low-flying attacks have to be made on specified targets. The converging bombing attack of R.A.F. displays at Hendon is no longer practised, for the very good reason that the pilots have plenty to do in a strafe without working out a maypole dance.

The attack to-day can only be termed a swarm attack. Following closely the contour of the ground, the machines arrive at the target often both unseen and unheard. Pandemonium reigns for a few minutes and the attackers are gone as fast as they came.

Operational experience is, of course, worth more than all the synthetic practices put together. Because of this the Mustang squadrons of Army Co-operation Command are taking part in the low-flying sweeps over occupied territory under Fighter Command. This they will continue to do until the day dawns when the main British and Allied forces pick their battleground on the Continent.

All operations, so far, have been of the "ground strafing" variety. They usually hunt in packs of two or three—ever since the first sortie—which was carried out by a single machine.

On the first Mustang operational flight the pilot saw much and chose as his target two hangars. As soon as he opened fire he was attacked by anti-aircraft batteries, which he quickly silenced. Later he found a goods train with steam up and tried his guns out on it. He returned and reported success. A few days later four Mustangs set off and during the hunt for the enemy attacked some soldiers on a beach, a factory, light gun positions, and a wireless station. The pilot who attacked the wireless station came down so low that his wings hit the aerial between two pylons.

The Mustang was first dealt with in our issue of December 18th, 1941, but more details are now available. It comes from the same stable as the renowned Harvard trainer (on which so many of our pilots have been trained) and the N.A. Mitchell high-speed medium bomber which was responsible for bombing Tokio. It is built to a British specification and has a distinct streak of the Messerschmitt 109 in its make-up. This is not to be wondered at when it is remembered that the designer spent some 12 years in Messerschmitt's drawing office. This is not the first case of design staffs changing their allegiance and merging the products of two firms.

In conception the Mustang is right up to date. The lines of its flush-riveted body and wings are sleek and business like. It looks every inch a warrior.

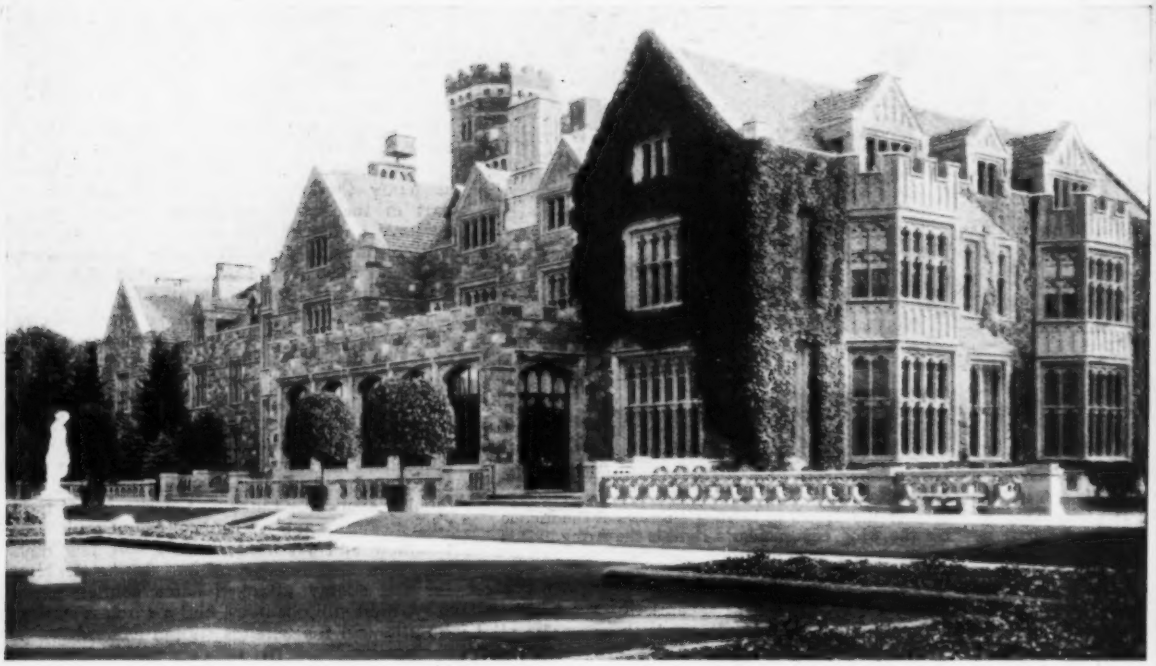
Two Army Co-operation Mustangs on reconnaissance. Nowadays this is carried out at high speed and almost at ground level.

Safety Locks

The dual purpose radiator for both oil and glycol cooling is set beneath the fuselage well aft of the pilot and, despite the long lengths of piping required, no more than the usual "plumbing" troubles are experienced. Contrary to general practice in the United States, the tricycle arrangement of undercarriage has not been followed. The fitting of a nose wheel undoubtedly complicates the already difficult problem of putting all the necessary things in the front end of a fighter. All three wheels are retractable and the operation of a lever in the cockpit renders the tail wheel locked or steerable at will.

For starting up the 1,150 h.p. F3R Allison engine, an electric inertia starter is fitted. Once the operation of the Stromberg pressure injection carburettor is mastered, no trouble occurs on this score, but until the necessary experience is attained there is a tendency to get too rich a mixture. Large area flaps operate to increase lift and drag for landing, and for take-off they are lowered some 10 deg. A feature of the machine is that once the cockpit cover is locked and the engine started, it cannot be unlocked until the engine is switched off. Likewise, the undercarriage retraction gear cannot be operated while the machine is on the ground.

Altogether the Mustang is a good aircraft. It is particularly robust, a feature which is such a great asset in war despite the universal laying of runways of either wire, steel or concrete. Like any other machine, there are a few snags. Cockpit ventilation is one, and another is that the pilot has to undo, or at least loosen, his harness to reach the lever which operates the hydraulic undercarriage.



The main residence of the Guggenheim estate contains 40 rooms and overlooks Long Island Sound. It has been presented to the Institute of the Aeronautical Sciences and re-named Daniel Guggenheim Park.

AMERICAN MUNIFICENCE

Gifts by Mrs. Guggenheim and Glenn L. Martin Make the Institute of the Aeronautical Sciences One of the Most Heavily Endowed Scientific Societies

RECENTLY the Institute of the Aeronautical Sciences, New York, which is the American equivalent of our Royal Aeronautical Society, announced two magnificent gifts devoted to the advancement of aeronautical research. Already the Institute of the Aeronautical Sciences has received generous support and administers the following funds: the Paul Kollsman of $65,000; the Sherman Fairchild of $25,000; the R. H. Fleet of $10,000; the Laurence Sperry of $10,000; the Vernon Lynch of $10,000; and the Benefactor Members Fund of $22,000.

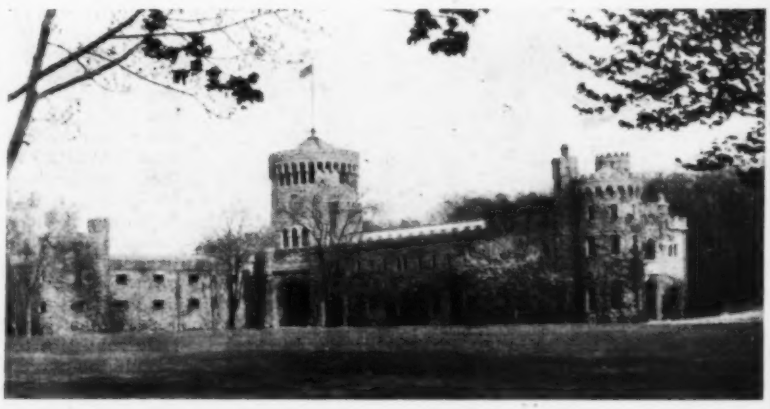
The two recent additions are the gift by Mrs. Guggenheim, wife of the late Mr. Daniel Guggenheim, of her estate at Sands Point, near Port Washington, Long Island, and the other the gift of 25,000 shares in the Glenn Martin company by Mr. Glenn L. Martin.

Sands Point Estate

Daniel Guggenheim Park is the name given by the Council of the Institute of the Aeronautical Sciences to Mrs. Guggenheim's Sands Point estate, which is of 162 acres and has a water front of two-thirds of a mile. The main residence has 40 rooms and overlooks Long Island Sound. Other buildings are suitable for laboratories and experimental investigations, and one of them has been named the Minta Martin Aeronautical Laboratory, to commemorate the mother of the famous American aircraft constructor whose gift of 25,000 shares will provide funds for research.

So far it has not been decided, or at any rate has not been announced, what form the new research establishment will ultimately take, but the Guggenheim family has always been greatly concerned with aviation physiology, and it may be assumed that this will loom large in any future programme. It also seems likely that the estate may be used for scholarships, and as a meeting place for scientists, engineers, physiologists and meteorologists.

It may be recalled that the late Mr. Daniel Guggenheim established the Daniel Guggenheim Fund for the Promotion of Aeronautics with deeds of gift totalling some $2,800,000. Prior to the formation of this fund the donor had established the Daniel Guggenheim School of Aeronautics at the New York



The Minta Martin Aeronautical Laboratory at Guggenheim Park has been endowed with shares in the Glenn Martin company, valued at more than $450,000.

AMERICAN MUNIFICENCE

University, with an endowment of $500,000. This fund endowed schools of aeronautics at the Massachusetts Institute of Technology, at the Georgia School of Technology, at the California Institute of Technology, at the University of Washington, at Leland Stanford University, at the Syracuse University, and at the University of Michigan. It also gave $250,000 for the establishment of the Airship Institute at Akron, and assisted in a great many other directions. During the existence of the fund Mr. Harry F. Guggenheim, son of the founder, was its president. He was a naval aviator during the first world war and is now on active duty again as a Lieutenant Commander in the U.S. Navy. Safe flying was a great pre-occupation of the Guggenheims, and the competition held some years ago, in which a Handley Page biplane competed, was designed to produce safe aircraft. It can hardly be said to have succeeded, but that was not the fault of the donor.

Stratosphere Research

Glenn L. Martin is one of the pioneers of American aviation, and from the earliest days there have always been Martin aircraft in use in the United States. Mr. Martin's mother has been a firm believer not only in her son but in the immense future of flying, and it is very fitting that the Institute of the Aeronautical Sciences should have decided to name the laboratory at Sands Point after her.

Mr. Martin, in informing the Institute of his intention to establish the Minta Martin Fund, said: "As the effect on pilots of high-altitude flying is one of the great problems requiring study, I hope that from the large laboratory building which the Council of the Institute of the Aeronautical Sciences has named the Minta Martin Aeronautical Laboratory, development will come which will make flying in the sub-stratosphere more comfortable and safer for our combat pilots. It is also important that after the war passengers be flown at higher altitudes. If, from this fund, new knowledge can come which will solve some of these problems, I shall feel that this endowment has been put to excellent use, not only for our war effort but in looking forward to the great use of the airplane when peace returns."

DR. LANCHESTER—PROPHET

His 26-year-old Book, "Aircraft in Warfare," Reviewed Again To-day

BOOKS, however eminent their authors, are rarely reviewed twice. But Dr. F. W. Lanchester's *Aircraft in Warfare*, which first appeared as a series of articles in *Engineering* during the period September to December of 1914 and was subsequently published in book form in January, 1916, makes particularly fascinating reading to-day.

Actually the work is even a little older than the date of first publication in article form suggests, for the original draft was prepared in 1913-14 and the revised M.S. completed in August, 1914. It will be appreciated, therefore, that Dr. Lanchester had not even the early happenings of the last war to influence or guide him then, although it may well be that between the appearance of the articles at the end of 1914 and the publishing of the book some 12 months later, one or two passages may have been slightly revised in the light of lessons taught, or indications observed, during the first 16 months of the 1914-18 war.

But even supposing that to be so, it in no way minimises the truly extraordinary accuracy of the author in the many forecasts he makes, both as regards the needs in future aerial wars and the developments in military aircraft.

When *Flight* reviewed this book on January 20th, 1916, it described it as "a highly valuable contribution to the science of aviation." It was certainly that, but had the reviewer been blessed with prophetic powers comparable to the shrewd foresight possessed by Dr. Lanchester, he would undoubtedly have been even more enthusiastic.

One has only to read *Aircraft in Warfare* to appreciate that its author was no mystic visionary when he wrote it, for his prophecies were the result of logical reasonings clearly set forth; they were the fruits of intelligent imagination controlled by a calmly scientific brain. He foresaw, long before most of his contemporaries, the various capacities in which aircraft might and eventually would serve the military (and naval) machine and how vital would be its share in future warfare, and he proceeded to examine the many problems presented in detail and to reason out how they would eventually be met and overcome.

Fighter Foretold

When Dr. Lanchester prepared his original M.S. no aircraft had ever been fitted with a gun, the popular military view in those days being that the scope of the heavier-than-air flying machine was confined to directing artillery, scouting and reconnaissance. But Dr. Lanchester wrote: ". . . in the new Arm we have a force . . . which before long will become an actual fighting force of no mean importance," and he discussed the specialised fighter with multiple machine guns almost as we know it to-day.

That he had a complete understanding of the future potentialities of air power and its prime strategical significance was made abundantly clear when he wrote: "It is the author's opinion that the time will come when the total and irretrievable loss of the command of the air to an enemy will be regarded as a disaster of an altogether irreparable and decisive kind, and although there may be a great deal of fighting still before the end, nothing less than an overwhelming superiority in the other arms will save an army deprived of its air service from ultimate defeat."

Naturally enough, everything in the development of the military aircraft has not come about precisely as Dr. Lanchester anticipated. Probably the most obvious example of this is his comment, "Needless to say, the single-man machine is not a fighting type——" and he added that the single-seater would be used chiefly for reconnaissance and bomb-dropping. In this he may be credited with having been almost half right, since, though we now immediately think of large multi-engined aircraft where bomb-dropping is concerned, we must not forget the fine work being done to-day by the fighter-bomber. All the same, the single-seater is primarily a fighter while the bomber, as a type, grows bigger and bigger.

So far, however (and in spite of the secret American bomb-sight), Dr. Lanchester's opinion that "It is doubtful whether bomb-dropping from aeroplanes will ever be found to compete with gunfire on the score of accuracy" has not been falsified.

Three developments which Dr. Lanchester foresaw in those early days were well on the mark, however. He was quite definite about the elimination of the airship as an active participant in aerial warfare, he foretold the advent of the air-borne torpedo for aerial attack upon warships, and he gave such a detailed description of the aircraft carrier to come that he might also be said to have "invented" it.

This was, indeed, a remarkable book, and it is unfortunate that there are not many copies in existence.

FIGHTER TAKE-OFF WEIGHT

Rapid and Accurate System for Estimating a New Design

By W. NICHOLS, A.R.Ae.S.

THE estimation of weights and the ultimate take-off weight offers more difficulties probably than any other branch of aircraft design. Geometrical similarity and theoretical considerations are limited in application, and average data from similar existing types can only be applied up to a point and can also be very misleading in certain cases.

In searching for a system or method whereby at the commencement of a new design a rapid and accurate estimate can be made, it was found convenient to classify existing types, including foreign aircraft of which details are available, into groups according to the purpose for which they were designed. This article deals exclusively with the fighter class. To avoid confusion fighter type aircraft must again be regrouped according to the table in Fig. 1, which shows the variation in types of the fighter class

Fig. 1. "FIGHTER" TYPES

Class	Crew	Engines	Average Gross Weight (lb.)
A	One	One	6,900
B	One	One	10,500
C	Two	One	8,300
D	One	Two	10,000
E	Two	Two	20,500

The most common type of fighter is, of course, the single-seater with one engine; in view of the data available it was decided to investigate the problem of this class first.

It became apparent at once that, while average data applied with a reasonable degree of accuracy to unit and component weights, it gave no reliable indication to the final take-off weight.

Fig. 2 is a tabulated weights distribution chart for a complete aircraft, and as a percentage of the take-off weight each main weight, unit and component weight has been assessed. This chart has been compiled from average data of existing types of similar aircraft and is sufficiently accurate to be of practical use when allotting the weight distribution for a new design.

Basic Operational Equipped Weight

It should be noted that change-over of the power unit from a liquid-cooled engine to an air-cooled radial engine does not make any appreciable difference to the total for the power unit. If anything, the liquid-cooled installation is a little superior from the weight point of view. Applying average data in an attempt to find the take-off weight, as previously stated, was found unreliable, and a curve plotting known values of average load carried, against take-off weight for a number of apparently similar types proved to be inaccurate up to 8 per cent. and over.

A most noticeable fact, however, was that the basic operational equipped weight (see Fig. 2) remained at or very close to 89 per cent. of the take-off weight in every case, and as a matter of fact this particular weight remains closely constant as a percentage of the take-off weight for all military aircraft, though not, of course, necessarily 89 per cent. as in this case.

At this point average data no longer applies due to the great variation in the fuel load in what otherwise appear to be similar aircraft. Tackling the problem practically, however, it is assumed that an estimate for the take-off weight is required for a new S.S. fighter design. From the specification the range and performance will be stated, and from the specified engine data the fuel and oil load for this range or endurance can be calculated.

Likewise the removable load, which includes guns, ammunition, removable equipment and crew. In this case one will be stated, and again the weight for the removable load can be calculated.

As the basic operational weight averages more or less constant, it was assumed that some relation between these two loads should give a reasonably accurate estimate of the take-off weight. This proved correct, and as a result the curve in Fig. 3 was evolved. This curve shows the value of $\frac{\text{Removable Load}}{\text{Weight of Fuel and Oil Max.}}$ which can be referred to as β plotted against a weight coefficient $C^w/10^3$ or $C^w \times 1{,}000$ for a full load of from 80 to 200 gallons, including the equivalent weight of oil which covers the "full supply" load carried for all aircraft within this category.

Practical Application

As to the practical value of the use of the Curve in Fig 3, assume from the specification for a new design the fuel and oil required for the necessary endurance are: Fuel 88 gallons, oil 8.5 gallons, giving a weight for these two items of 757 lb. Also from the specification the "removable load" is found to be 605 lb. Incidentally, these weights actually apply to the Messerschmitt fighter Me.109F.

From the above $\beta = \frac{605}{757} = 0.8$, and from the curve in Fig. 3 for $\beta = 0.8$ $C^w = 7{,}600$

$\therefore$ Take-off weight $= 7{,}600 \times 0.8 = 6{,}080$ lb.

			%
TAKE-OFF WEIGHT			
BASIC OPERATIONAL EQUIPPED WEIGHT			
TARE WEIGHT			
BARE WEIGHT			
POWER PLANT	STRUCTURE	WINGS	WINGS INCLUDING CENTRE SECTION	15·0
			MAIN UNDERCARRIAGE UNIT	4·7
			TOTAL-WING UNIT	19·7
		TAIL-UNIT	TAILPLANE & ELEVATORS	1·27
			FIN & RUDDER	0·55
			TOTAL-TAIL UNIT	1·82
		FUSELAGE	FUSELAGE COMPLETE	7·12
			TAILWHEEL UNIT	0·52
			ENGINE MOUNTING & COWLING	2·42
			TOTAL-FUSELAGE UNIT	10·06
			FLYING CONTROLS-TOTAL	1·23
			TOTAL FOR STRUCTURE	32·8
		POWER UNIT	ENGINE (DRY)	21·2
			AIRSCREW COMPLETE	4·95
			RADIATOR, PIPING, COWLING, COOLANT	5·8
			ACCESSORIES	1·93
			TOTAL-POWER UNIT	33·88
		FUEL SUPPLY	FUEL TANKS	0·96
			FUEL SYSTEM	0·36
			OIL TANKS	0·17
			OIL SYSTEM	0·61
			FUEL SUPPLY UNIT-TOTAL	2·1
			TOTAL FOR POWER PLANT	36·0
			TOTAL BARE WEIGHT	68·8
	PROTECTION & FIXED LOAD		PROTECTIVE ITEMS	2·4
			FIXED ARMAMENT & FIXED LOAD	4·6
			TOTAL TARE WEIGHT	75·8
	REMOVABLE LOAD		REMOVABLE ARMAMENT, REMOVABLE EQUIPMENT, CREW	13·2
			TOTAL-REMOVABLE LOAD	13·2
			TOTAL BASIC OPERATIONAL EQUIPPED WEIGHT	89·0
	FUEL AND OIL LOAD		FUEL	10·0
			OIL	1·0
			TOTAL-FUEL & OIL	11·0
			TAKE-OFF WEIGHT	100·0

Fig. 2. Average weight distribution as percentage of take-off weight for fighter aircraft, Class A.

FIGHTER TAKE-OFF WEIGHT

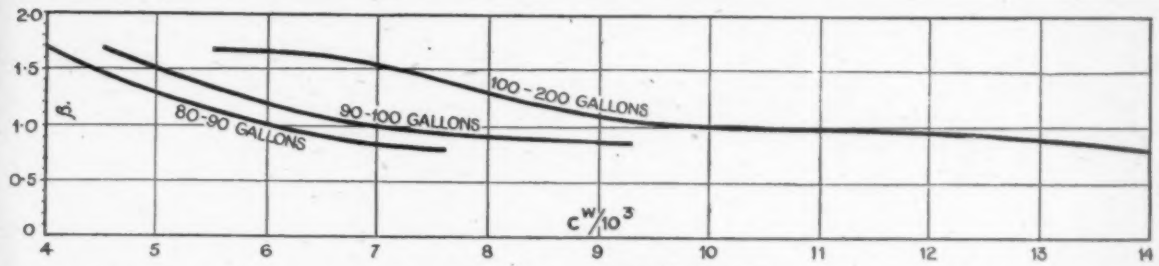


Fig. 3. Take-off weight of single-seater fighter aircraft. $\beta = \frac{\text{Removable load (lb.)}}{\text{Fuel and oil (lb.)}}$; Take-off weight $= C^w \times \beta$. Degree of accuracy $= \pm 2$ per cent.

The take-off weight of the Me.109F is 6,054 lb., so that the curve in this case is accurate to within 0.5 per cent. and is sufficient to be of practical value.

As a further example of a more highly loaded aircraft, assume fuel and oil load 1,290 lb., the quantity of fuel being 155 gallons, and the removable load to equal 1,200 lb. In this case $\beta = \frac{1,200}{1,290} = 0.93$. From curve 100-200 gallons and $\beta = 0.93$ $C^w = 11,400$ lb. ∴ Take-off weight $= 11,400 \times 0.93 = 10,602$ lb. These latter figures do not, of course, refer to any particular design.

Having obtained by use of the curve in Fig. 3 the take-off weight, the weight of each unit and component can be allotted by the use of the chart in Fig. 2, and from this load distribution the "C.G." positions can readily be found or checked.

These weights should also be issued to the drawing office so that during detail design every effort is made to see that these weights are not exceeded.

Should for any reason either the fuel and oil load or removable load, or both, be changed during the design stage, or after the prototype has flown, as frequently happens, the result of such change in the take-off weight can quickly be checked from further reference to the curve for the new value of β.

It should be borne in mind, however, that the curve in Fig. 3 applies strictly to single-seater fighters only, and obviously does not cater for the heavier class of machine, for which sufficient data are not available.

Other data which came to light during this investigation and which may be of interest are as follows: The average weight of fuel tanks (bare, unprotected) of aluminium varies from 0.77 lb. per gallon capacity for 85-gallon tanks to 0.53 lb. per gallon capacity for aluminium tanks of 200 gallons capacity. Oil tanks (aluminium) appear to average approx. 1.5 lb. per gallon capacity.

The average wing weight per sq. ft. of nett area, but including flaps and ailerons, is approx. 4.75 lb. Average power loading at take-off = 5.8 lb./h.p. Average wing loading 27.42 lb./sq. ft. Average span loading = 179.54 lb. per ft. span.

Referring back to the chart in Fig. 2, it will be obvious that the removable load and the fuel and oil load will not always be as stated, i.e., 13.2 per cent. and 11 per cent. respectively, and under these conditions it will be necessary to fix or adjust the basic operational-equipped weight according to the difference. It will always be found, however, to be very close to the average figure given: 89 per cent.

In the case of aircraft in Class "B" the average basic operational-equipped weight as a percentage of the take-off weight will probably be 87.5 per cent., and the remaining items will not be likely to vary more than ±2 per cent. from those given for Class "A."

DUTCH PILOTS' NEW JOB

K.N.I.L.M. Personnel in U.S.A.

SEVERAL "millionaires of the air," as Dutch fliers are now called who flew more than 1,000,000 miles between Holland and the Dutch East Indies and Australia before the Pacific War (as well as other air personnel), are going to the United States to take up a new war job for the United Nations.

This decision was recently made, but it is expected that they will also be used as instructors for the 800 Dutch lads who escaped from the flying school at Java during the Japanese invasion and are now being trained somewhere in America.

Among these Dutch "millionaires" is the famous Smirnoff, whose last adventure at Broome (when he ran into Japanese trouble when bringing out evacuees from Java) presented him with four bullets in his legs and arms, but who has already completely recovered. Smirnoff symbolises the co-operation of Holland and Russia, for he was born in Russia but was naturalised in Holland twenty years ago.

Another famous flyer is the K.N.I.L.M. Commodore van Messel, who was the first pilot of the bi-weekly airline between Australia and the Netherlands East Indies for the past three years.

Others of this group have had many duties to perform in other parts of the world, but their experience during and after the invasion, when they continued operating between Singapore and Java, as they evacuated scores of people through bullet-ridden skies, has proved their great worth to the Allied cause.

Dunlop, one of the youngest civil fliers in the party, was the last to depart from Java after several hazardous trips to Australia. He landed and took off from the ordinary roadway where no air-liner was normally believed ever to be able to operate. But during the past few months these pilots have learned that "what we used to call impossible is now only just difficult, and that we can do it if we try hard enough."

These Dutch "millionaires of the air" all express themselves as eagerly looking forward to their opportunity in the new world.

INTERNATIONAL AIR CONTROL

Flying Police Force to Prevent Future Aggression : No Geographical Barriers for Civil Aviation

By GROUP CAPTAIN R. E. G. FULJAMES, M.C., B.A., A.F.R.Ae.S

THOSE of us who were privileged to hear the Rt. Hon. Lord Brabazon, M.C., P.C., deliver the Wilbur Wright Memorial Lecture for 1942, were rewarded by a most interesting history of aviation, a critical analysis of aircraft uses in this war, and a far-sighted picture of the post-war period. It is to the last part of this lecture I should like to draw special attention. When in the past political theorists have talked of internationalising aircraft to prevent them from being misused by warlike aggressors, we were inclined to dismiss the idea as impractical and likely to hinder the proper development of the aircraft industry. When an authority on aviation like Lord Brabazon appeals not just to the scientific world but to all social reformers and to those who love their country to think this thing out, and himself outlines a scheme for a world-wide development and control of aviation, we must needs take notice.

In Lord Brabazon's view the United Nations must take charge of all aircraft and all flying ; they will fly wherever they like ; this organisation will see that nowhere in the world shall a nation secretly build up an air force for mischief. It will be controlled by a World Board, which will guarantee all States against aggression and will constitute itself the policemen of the world. This will be a force of transcending power that no one can challenge—not a debating chamber with no force at its command. No doubt our present enemies would at the proper time be brought into the scheme, for this idea is world co-operation and not penalisation. It is high time, with the resources at our command, that we protected ourselves against a world war every generation ; and here in our hands we have the instrument so to do.

Worth Serious Attention

The idea of an International Air Police Force is not new and it has, perhaps, received less serious attention than it deserves. Lord Brabazon himself referred to Kipling's A.B.C., a truly prophetic picture of what might be, a *pax aeronautica* guaranteed by an Aerial Board of Control. General P. R. C. Groves, our Military Representative at the Versailles Peace Conference at the end of the last war, advocated the development of an International Air Force as the sanction of the League. Air Commodore L. E. O. Charlton and other military and air force critics have advocated similar ideas. The New Commonwealth Society, whose President is now our Prime Minister, has for its objects :—

To secure international justice through the establisment of—

(1) An Equity Tribunal for the purpose of settling all disputes, and

(2) A Police Force to uphold international law and order.

Perhaps the most important of similar proposals was that presented by the French Government to the Disarmament Conference at Geneva in November, 1932. The French are always logical, but their scheme was bristling with difficulties. It seemed to us that the French wanted to make the League of Nations an extension of their own Foreign Office, to create a force to subjugate their late enemies and to maintain for ever the *status quo*, which was never intended by the League Covenant. We feared that the international control of aviation would further hinder an already struggling aircraft industry. For these and kindred reasons the French plan was not acceptable.

The aircraft industry is undoubtedly giving these post-war problems some consideration, and thoughtful forecasts have been made by certain aircraft designers in the series of talks recently broadcast. Mr. L. G. Frise, of the Bristol Aircraft Company, stated: "Although we have seen so much of our work turned to the waging of war, we have in the airplane the strongest weapon also for peace, in that it can reduce the size of the world and make isolation and the flourishing of pernicious doctrines anywhere impossible."

Some measure of international control of civil aviation will undoubtedly be necessary to prevent its misuse, and to encourage its world-wide development and freedom of action over national barriers. On the other hand it may be that, if the International Authority controls a powerful International Air Force, equipped with first-class fighting and bombing aircraft, there need be very little interference with civil aviation, since it cannot be a serious threat to security. The urgent necessity is to organise all military aircraft as the sanction of the International Authority.

A Dangerous Attitude

The post-war period, however we look at it, is full of difficulties but also full of opportunities. Men of imagination must consider these problems and plan and arrange for the future. Let the Royal Aeronautical Society itself set up a committee to make recommendations. There are those who argue that reconstruction is an affair of the post-war period, and that it is premature during hostilities to examine such problems. This is a dangerous attitude. Though we cannot afford to divert anything from our war effort, we can at least do some thinking on the matter and work out our plans for a more secure future. Much will depend on the existence of a government ready to give a clear and decisive lead ; and this lead will not be forthcoming unless policy has been considered and plans carefully formulated in advance.

Hitlers come and go : the world is not static. We are fighting primarily to establish a better and a more secure International system, rather than the retention of our democratic way of life. There is little hope for any International Authority, unless there is International Force behind it. This involves some loss of sovereignty as part of the cost of peace in the modern world : if we really want peace, we must face up to it.

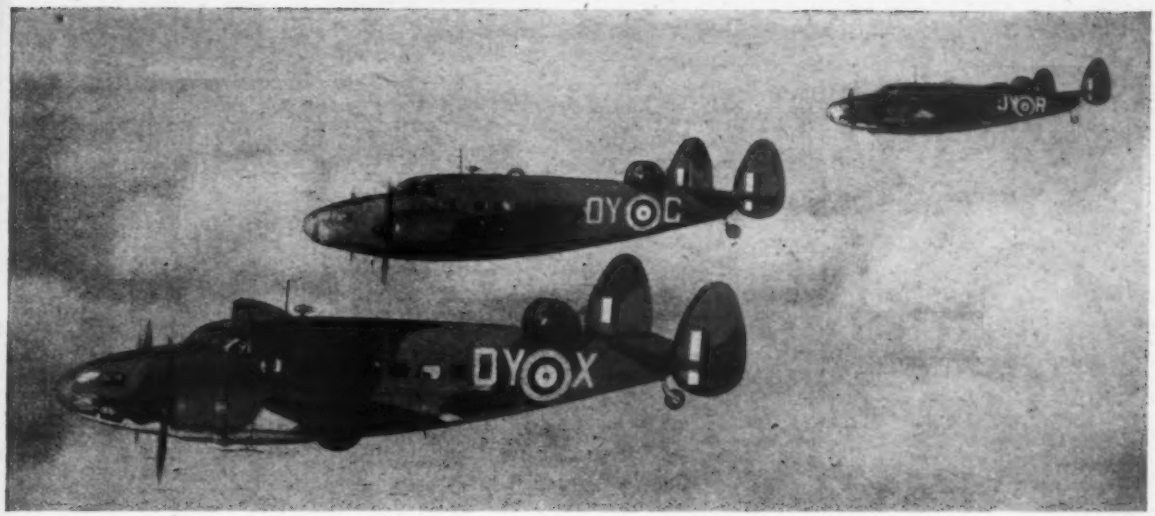
The world of the past decade has been a bad and a mad world, and much needs to be uprooted and replanted. But, as Lord Brabazon warns us, "No amount of planning our lives and social progress can be of value or be permanent unless we see clearly and appreciate the potential danger that man has created through the conquest of the air, and so organise the future that it is no longer a threat, but becomes the servant of man. We are all going to be in danger again unless we co-operate immediately to see that, although we are far from the Kingdom of God, there is at least the possibility of a Kingdom of Men, and of a United Kingdom."

The 1941 "Jane's"

DESPITE the many difficulties and problems of these war-time days—from the shortage of paper to cramping restrictions—*Jane's All the World's Aircraft* has duly appeared for 1941, the price remaining at £3 3s.

This is, in fact, the third wartime edition and the first for which its compiler and editor, Mr. Leonard Bridgman, has been solely responsible. The quality of the 1941 *Jane's* has by no means suffered through the lack of its compiler's former collaborator ; indeed, it may fairly be said fully to maintain the high standard for which it has been noted throughout its thirty-one years of publication.

Considerations of national security have naturally meant that the information it contains about nations at war is not quite so full as it would have been in normal times, but there is a useful innovation to Section C in the form of more than 100 three-view general arrangement drawings of current types.



Three Hudson bombers of Coastal Command in echelon to starboard.

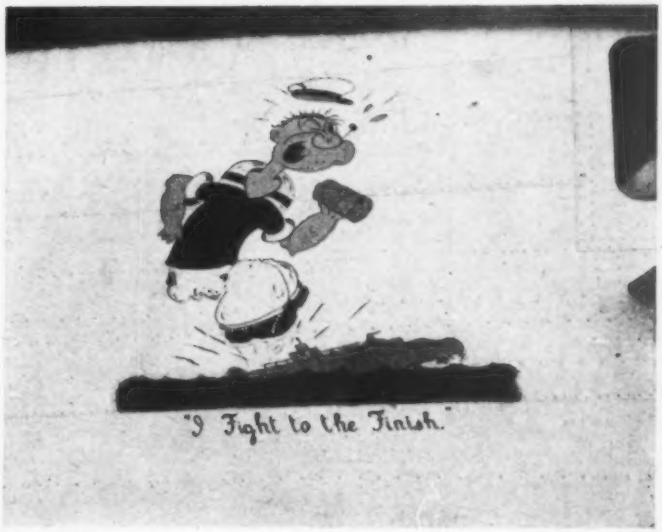
U-BOAT HUNTING

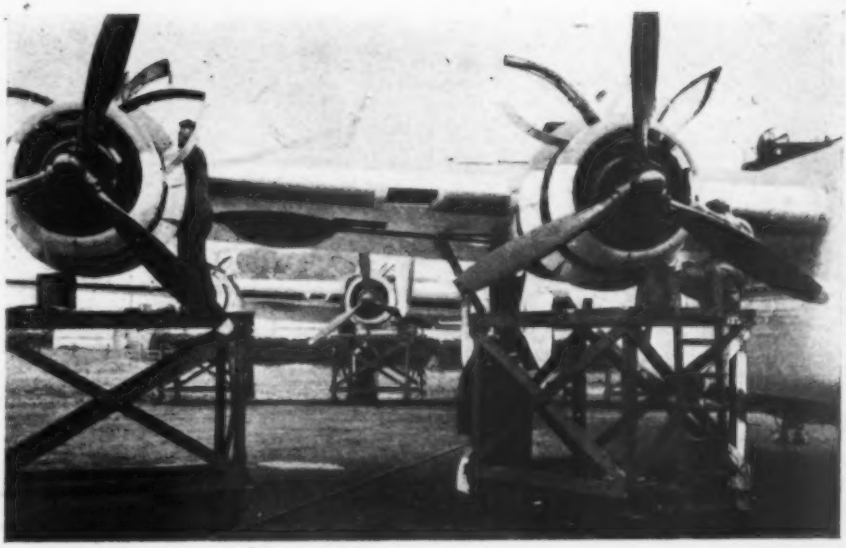
A Visit to a Coastal Command Station on the Atlantic Seaboard

WHEN the time comes for the activities of Coastal Command units to receive the full light of day, a wonderful story will be there for the telling. The ingenuity, bravery, patience and sheer hard work which has been employed during nearly three hard years of war is such that the country should be utterly thankful it has such men to give of their service.

More than 50,000,000 miles have been flown in these three years and, although the work accomplished has been just as vital for the interests of the country as Nelson's brilliant strategy at Trafalgar, the majority of this enormous mileage represents tedious patrols over blank stretches of sea where a split second's let-up in vigilance might mean the difference between making a U-boat kill or allowing it to start its war on shipping with totally unpredictable results.

Strangely enough, doubt does often creep in as to whether a submarine has been sunk or not. The Royal Navy, under whose operational orders the Coastal Command works, are particularly finicky over such matters, and pilots jokingly say they only get a possible





(Centre) The motif on the fuselage of a Coastal Command Liberator which has two F.W. Condors and a submarine to its credit. (Right) Overhauling the 1,200 h.p. Pratt and Whitney Twin Wasps on Coastal Command Liberators.

U-BOAT HUNTING

when they bring the U-boat captain and half the conning tower home, because it is just within the bounds of possibility that the submarine made its base under the charge of its second in command. And certainly strange things happen, as is instanced by the amazing case of our own submarine *Thrasher* which received two direct hits by bombs, neither of which exploded.

At the cinema, submarine sinking seems so simple. A dashing aircraft or destroyer drops a pattern of depth charges in the proximity of the sub. and the next moment one is shown the inside of the vessel, with instruments all broken and water pouring in through gaping holes in the hull. That is an entirely wrong picture. The pressure hull of a modern German submarine is $1\frac{7}{8}$in. thick and compartmented every six or seven feet of its length. This means that unless the depth charge or bomb is almost in contact with the hull it is doubtful whether a kill has been made. It may be that the damage is sufficient to drive the enemy back to his base, but he lives to fight another day—if sinking merchant ships can be called fighting!

An ordinary length patrol over the sea is actually much longer in practice, because three or four hours will elapse while briefing goes on and everything is prepared. When the machine returns to base, if anything has been seen—which is, on the average, about twice a week—there is an interrogation to go through which is as thorough as a Gestapo third degree, with the rubber truncheons left out. Other routine jobs to be done are photographic reconnaissances, convoy protection patrols and meteorological flights on Hudsons. These last entail trips of many hundred miles at more than 20,000ft.

The devotion and care shown by ground crews is of a very high standard throughout the Royal Air Force. Bomber Command operates mostly at night—Fighter Command operates mostly by day, but Coastal Command puts in 24 hours every day, be the weather fair or foul, and, therefore, the machines receive much harder wear and the maintenance work is doubled. Nearly all flying is over the sea, with very little hope of rescue should a mishap occur far out to sea. Reliability must be as near 100 per cent. as is humanly possible, and the ground crews work very hard to ensure that it is.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ECONOMY IN DESIGN

Hurricane Rudder Posts were Modified

REFERRING to a letter in your last issue concerning the construction of the Hurricane rudder, Mr. Muirhead is quite correct in assuming that the bottom extension on the rudder post is the outcome of a modification.

This method was adopted to utilise the large number of cut tubes held in store, although the modification at the time also called for a full length tube to be used when existing stocks were consumed.

All rudders made since the expiration of the old stocks embody the one piece full length tube.

For and on behalf of Hawker Aircraft, Limited.
R. H. CHAPLIN.

AIRCRAFT CLUB RE-OPENS

Bank Holiday Model Exhibition

I THINK you would like to know that The Aircraft Club, Harrogate, has reopened and that all old members will be welcome on Friday nights as usual.

The model aircraft and the glider constructional sections are now in operation. The S.T.G. glider has been overhauled and a new one is three-quarters built. Every effort is being made to obtain a permit to fly, so that we can pass on some of our experiences, hardly earned over many years, to a younger generation before it is too late.

There is to be an exhibition of model aircraft on the lawn (weather permitting) in front of the club room during Bank Holiday week. An S.T.G. and the Zephyr gliders may also be on view if the weather is favourable.

Those who have previously been members of the club are to be allowed to renew their membership for a reduced subscription if they are too far away to take part in activities, and it is hoped they will give us all the support they can.

I was delighted to see the article on the stout effort of De Havilland, Canada, in *Flight* of June 25th. I might almost have written some of that article myself and cannot help wondering whether any of our old members helped in its construction or whether some of our often expressed views reached Canada. Anyhow, good luck to it, and I have no doubt that a firm of De Havilland's standing will soon discover for themselves one or two little points in its design which we found out some years ago in actual practice with the S.T.G.

I hope *Flight* will carry on its effort to have the gliding ban removed, so that we can teach young people.

I do not think that either the dearest old lady or youngest Air Ministry damsel could ever mistake our open frame S.T.G. or De Havilland glider for an enemy aircraft, which I understand is the chief reason for the ban on gliding.

E. T. W. ADDYMAN.

BOMBER ARMAMENT

Weight or Rate of Fire?

I HAVE just come across a copy of *Flight* of May 14th, containing a letter by Mr. G. S. Henderson on armament in bombers, and I feel I cannot let the claims put forward by him go unanswered. While I agree that it would be impracticable to fit four cannon in a turret of the existing type, I do not believe that two-cannon turrets should be ruled out by "rate of fire," as Mr. Henderson puts it. It seems that he thinks only in terms of "rate of fire," forgetting the equally important "weight of fire."

Now that all fighters are well armour-plated a good burst from a four M.G. turret often does no real damage at all.

The effect of cannon fire is vastly different, and even though one may not get as many hits as with M.G.s, the comparative result more than justifies their use in turrets. "HART."

AD ASTRA

It Was the Right Wright!

MR. GRIFFITH BREWER, who was so long associated with the Wright Bros., is, of course, right in saying that the original Wright machine was sent to the Science Museum.

I had several chats with Mr. Orville Wright in Dayton, Ohio, about this aircraft and the disagreement with the Smithsonian Institution that led to its being sent to England.

Mr. Wright took me over his private workshops (just around the corner from the shop in which the first 'plane was constructed), where he was building a replica of the one he sent to England.

I recollect that he was a sufferer, as I was at that time, from sciatica, due to a sacro-iliac weakness. I asked to what he attributed it, and he said to the intense vibration set up in his early 'planes. It had become so acute that the only vehicle ('plane, ship, and train included) in which he could risk travelling was a Franklin car of rather ancient vintage equipped with modified aeroplane tyres.

That was about 12 years ago. Meanwhile designers have been able to repay the industry's debt of gratitude to the Wrights by producing aircraft in which no doubt even Orville Wright can travel without discomfort.

Boulton Paul Aircraft. J. C. C. BULLOCK.

Service Aviation

A close-up of a General Aircraft Hotspur glider on tow. On operational flights the wheels are jettisoned after take-off and the landing made on the central skid. The point of attachment of the tow is of interest.

Royal Air Force and Fleet Air Arm News and Announcements

Promotion

The London Gazette, July 21, 1942.

Air Cmdre. W. B. CUSHION, C.B.E., to be Act. Air Vice-Marshal, June 21, 1942.

Retirements

Air Chief Marshal Sir Hugh C. T. DOWDING, G.C.B., G.C.V.O., C.M.G., A.D.C., is placed on the retired list at his own request. July 15, 1942.

Air Vice-Marshal Sir Patrick H. L. PLAYFAIR, K.B.E., C.B., C.V.O., M.C., is placed on the retired list and retains the rank of Air Marshal. July 20, 1942.

Grp. Capt. (Temp. Air Cmdre.) A. N. GALLEHAWK, A.F.C., is placed on the retired list and retains the rank of Air Cmdre. March 11, 1942.

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

BAR TO THE DISTINGUISHED FLYING CROSS

Act. Sqn. Ldr. J. G. TOPHAM, D.F.C., No. 219 Sqn.—This officer has performed work of outstanding merit. A skilful pilot and a fine leader, Sqn. Ldr. Topham has been tireless in his efforts to attain success. By his personal example he has been largely responsible for the high standard of morale existing in his squadron. Sqn. Ldr. Topham has destroyed five enemy aircraft during sorties at night.

Act. Wing Cdr. I. S. SMITH, D.F.C., No. 151 Sqn.—One night in February, 1942, this officer accomplished excellent work during an engagement with hostile aircraft which attempted to attack a convoy. He destroyed one and damaged another of the raiding aircraft. During a patrol one night in June, 1942, Wing Cdr. Smith destroyed two and probably destroyed a third enemy aircraft. In all his combats he has displayed great judgment, skill and courage. He is a most efficient flight commander and fine leader.

F/O. A. H. ALDRIDGE, D.F.C., R.A.F.V.R., No. 217 Sqn.—F/O. Aldridge has attacked shipping on several occasions and, in spite of heavy anti-aircraft fire, he has achieved much success. During three attacks in June, in the Mediterranean, he hit an Italian warship, an enemy vessel which later sank, and disabled another. On the last occasion, F/O. Aldridge defied an extremely heavy defensive barrage.

DISTINGUISHED FLYING CROSS.

Act. Sqn Ldr. A. E. COOK, R.A.F.V.R., No. 235 Sqn.—This officer has led his section on numerous fighter escorts. In June, 1942, when escorting one of our convoys, he shot down a Ju.88, which attempted to attack. He also took part in a fighter escort during a recent air attack on an Italian naval force. Sqn. Ldr. Cook is a courageous and determined leader.

Flt. Lt. A. J. BRADLEY, No. 202 Sqn.—In May, 1942, this officer was the captain of a flying boat which during an operational flight in the Mediterranean area was attacked by two hostile fighters. Flt. Lt. Bradley and his fellow pilot were both seriously wounded by the enemy's opening fire. In spite of his grave injuries, Flt. Lt. Bradley remained at the controls and, although his vision was almost obscured by blood, he succeeded in bringing his aircraft down safely on the sea before he fainted.

After a short time he regained consciousness and resumed command. He gave detailed orders to his crew to make the flying boat as seaworthy as possible. Fully aware that his crew needed guidance, Flt. Lt. Bradley refused morphia to alleviate his injuries until a rescue was effected some two hours later. This officer displayed great courage, leadership and devotion to duty in very difficult circumstances.

Act. Flt. Lt. B. INGHAM, R.A.F.V.R., No 129

Flt. Lt. H. W. Ward (right) and W/O. J. E. Sunderland who have both been awarded the Air Force Cross for work in training paratroops. W/O. Sunderland has made over 40 jumps and Flt. Lt. Ward made his first descent in 1925.

SERVICE AVIATION

Sqn.—This officer has completed a large number of major operational sorties. He is an extremely efficient and reliable leader whose work has proved most valuable. During an attack on the warships Gneisenau and Scharnhorst at sea, Flt. Lt. Ingham shot down an enemy fighter which was attacking one of our aircraft. He has destroyed two enemy aircraft.

Act. Flt. Lt. R. Y. POWELL, No. 202 Sqn.—This officer has completed a large number of operational flying hours. He is a keen and efficient captain who has displayed great initiative and resource in the course of his tasks. In May, 1942, he made a skilful and successful attack on an enemy U-boat. During the same month he twice brought his flying boat down on to the sea and effected rescues. In the first instance, he rescued the crew of a Hudson aircraft who were afloat in their dinghy, and on the second occasion he rescued a dangerously wounded pilot. Flt. Lt. Powell has set an inspiring example.

Wing Cdr. D. R. EVANS.—This officer has undertaken a large number of hours flying at night and in all kinds of weather. On one occasion in January, 1942, he displayed both resource and skilful airmanship when executing a safe landing at an airfield near the coast, after one engine of his aircraft had ceased to function. The efficiency, keenness and enthusiasm of the unit he commands reflects great credit on the efforts of Wing Cdr. Evans, who has himself destroyed two enemy aircraft.

Act. Sqn. Ldr. R. G. ENGLAND, A.A.F., and P/O. G. S. BAKER, R.A.F.V.R., both of No. 88 Sqn.—In June, 1942, Sqn. Ldr. England and P/O. Baker were captain and navigator respectively of the leading aircraft of a bomber force which attacked shipping in Dunkirk Harbour. When nearing the target a fierce barrage of anti-aircraft fire was encountered. Undeterred, Sqn. Ldr. England resolutely pressed home his attack, skilfully guided to the selected target by P/O. Baker, who, accurately aiming and releasing his bombs, scored a hit on an enemy tanker. Throughout the operation Sqn. Ldr. England displayed brilliant leadership and high courage, while P/O. Baker's skilful navigation and accurate bombing contributed materially to the success achieved. Sqn. Ldr. England, accompanied by P/O. Baker as navigator, has led formations of aircraft on many sorties.

Act. Flt. Lt. E. N. WOODS, R.A.F.V.R., No. 72 Sqn.—This officer has participated in numerous sorties over enemy territory. He has led his flight, and occasionally the squadron, with courage, skill and judgment. His resourcefulness in difficult circumstances has helped to promote and maintain the high morale of the squadron. Flt. Lt. Woods has destroyed one and damaged two further enemy aircraft.

Flt. Lt. S. N. PEARCE, R.A.F.V.R.—Flt. Lt. Pearce has completed many reconnaissance flights in trying circumstances and under enemy fire. The successful results which he has achieved could be obtained only by exceptional keenness and skill.

Flt. Lt. F. A ROBINSON.—Since August, 1941, this officer has participated in many operational sorties and several long reconnaissances of Germany and German occupied territory. These have been undertaken often in adverse weather and with fierce enemy opposition. Flt. Lt. Robinson possesses ability and keenness, which are a great inspiration to his fellow pilots.

Flt. Lt. C. S. G. STANBURY, No. 70 Sqn.—This officer has completed 61 operational sorties. He has set a very high standard of efficiency, and his professional knowledge has been of great value. He is a most courageous captain, who, undeterred by the enemy's fire, presses home his attacks to the full.

Flt. Lt. J. W. STEWART, R.A.F.V.R., No. 208 Sqn.—This officer has participated in 27 sorties, and led his flight with courage and determination in difficult conditions. His conduct has been an inspiration to others. His fine qualities were to the fore during the particularly hazardous period before and during the withdrawal from Antelat.

Act. Flt. Lt. J. M. LANDER, R.A.F.V.R., No. 22 Sqn.—In April, 1942, this officer led a formation of eight aircraft in an attack on a defended Italian convoy in the Mediterranean. The convoy was escorted by large numbers of enemy aircraft. Despite this, the attack was pressed home with great determination, and many explosions were observed amongst the ships before the attack was broken off. On the return journey Flt. Lt. Lander's aircraft was attacked by enemy fighters. His aircraft was extensively damaged by the attacker's fire, but, by skilful tactics, Flt. Lt. Lander eventually evaded the enemy and made a safe landing.

Flt. Lt. E. COTTON, No. 502 Sqn.—Flt. Lt. Cotton has proved himself to be an enthusiastic and efficient pilot and a brilliant leader. His operational hours amount to 300. On one occasion when patrolling the Bay of Biscay he stalked a U-boat and made a successful attack while it was partly submerged.

F/O. J. G. GREY, R.N.Z.A.F., No. 104 Sqn.—This officer has participated in 40 operational sorties, seven of which were over Germany and France. On one occasion, during an attack on Berlin, his aircraft was hit by anti-aircraft fire whilst over the target area, but he succeeded in flying his damaged aircraft back to this country. In the Middle East he has participated in many successful attacks on enemy objectives. When acting as captain he bombed and machine-gunned the airfield at Castel Benito.

On another occasion he was detailed to attack an important supply dump near Tripoli. Despite appalling weather (the cloud base over the target area was never more than 1,000ft.), F/O. Grey found and successfully attacked the dump. His aircraft was badly damaged by machine-gun fire. It was reported by other aircraft which attacked the dump later, when the weather had cleared, that when they arrived, the target was a mass of flames. F/O. Grey has shown an aptitude and skill for operations far above the average.

F/O. C. P. T. HALLIWELL, R.A.F.V.R., No. 37 Sqn.—F/O. Halliwell is one of the best captains in the squadron. Included in the numerous sorties, he has completed air raids on targets in occupied territory in France, in Cyrenaica, Greece, Tripolitania, Sicily, and the Dodecanese. He has at all times shown courage, skill and leadership. F/O. Halliwell performed excellent work during the recent attachment of his squadron to Malta.

F/O. R. WEST, R.A.F.V.R., No. 249 Sqn.—This officer is a flight leader of great skill and courage. He has destroyed at least six enemy aircraft and damaged six others. On a recent occasion his successful leadership was well in evidence when his section destroyed three Italian fighters.

P/O. M. G. HORNBY, R.A.F.V.R., No. 203 Sqn.—This officer has displayed exceptional courage and devotion to duty. He has completed 80 operational sorties. He is extremely efficient, and has instilled a spirit of confidence in his crew. On a recent occasion his accurate report of the movements of an enemy convoy enabled a striking force to make a successful attack.

P/O. P. A. HUGGINS, R.A.F.V.R., No. 104 Sqn.—This officer has completed 42 operational sorties, 13 of which were against targets in Germany, France and Italy. During a daylight raid on Brest he showed great skill and initiative when the leading aircraft of his formation was hit by anti-aircraft fire, causing it to lose speed. Although anti-aircraft shells were exploding all around his leader's damaged aircraft, P/O. Huggins kept the closest formation. Enemy fighters which had approached would not close in on the tight formation. By his initiative, P/O. Huggins was of the greatest assistance to his stricken leader.

On another occasion, after releasing his bombs on the airfield at Castel Benito, he descended to 800 feet and machine-gunned aircraft on the ground, setting at least two of them on fire. In another action he was captain of one of a formation of four aircraft which attacked a convoy of four merchant ships and two destroyers. One of the merchant vessels was destroyed and two damaged. Although P/O. Huggins has made many flights in appalling weather and his aircraft has been often subjected to heavy enemy fire, he has never shown the slightest sign of tiring.

P/O. J. E. SWINGLER, R.C.A.F., No. 38 Sqn.—This officer has completed 39 sorties, which include raids on targets in Germany, Italy, Greece and Libya. He has always pressed home his attacks to the greatest advantage. In March he was detailed to attack shipping off Patra harbour. The attack had to be made across the harbour, but, in spite of heavy defensive fire, both from the ship selected for attack and the land defences, P/O. Swingler pressed home his attack at a low level. He released his torpedo from close range and obtained a hit on the objective. This was confirmed later by reconnaissance.

P/O. J. HURST, R.A.F.V.R., No. 603 Sqn.—This airman completed 54 operational sorties over France before being drafted to Malta, where, in a period of three weeks, he destroyed four, probably destroyed six, and damaged three enemy aircraft. He is a fearless pilot and an excellent section leader.

Wing Cdr. A. J. MASON, No. 39 Sqn.—In June, 1942, this officer led an attack on an Italian naval force. Despite fighter opposition, a determined attack was made and at least one warship was hit by a torpedo. His leadership and courage in the face of formidable opposition were worthy of the highest praise.

Flt. Lt. H. G. POCKLEY, R.A.A.F., No. 10 Sqn.—This officer has completed a large number of operational sorties against enemy shipping, both by day and by night, and has inflicted damage on both naval and merchant ships. His skill, tenacity and coolness under fire have set an inspiring example.

P/O S. J. JORDON, No. 488 Sqn.—P/O. Jordon is the rear gunner and wireless operator of a bomber. In June, 1942, his aircraft was attacked by two Focke Wulfe 190's. In the first of several attacks, P/O. Jordon coolly waited before firing a burst, which caused one of the pilots to break away with black smoke coming from his aircraft. Four further attacks were made by the remaining fighter, during which P/O. Jordon, by his excellent directions, enabled his pilot to outmanœuvre the attacks. Whenever the pilot's evasive action enabled him to bring his guns into action, P/O. Jordon used them effectively. Throughout the engagement he displayed great courage and skill, which contributed materially to the safe return of his aircraft.

DISTINGUISHED FLYING MEDAL

Sgt. L. R. COLQUHOUN.—During the passage of our convoys to Malta, Sgt. Colquhoun carried out valuable reconnaissance flights to obtain information regarding the disposition of the Italian naval force. Twice in one day he completed flights of more than 600 miles over the sea and shadowed enemy ship movements. Much valuable information was secured as a result of his determined and skilful efforts.

Sgt. S. G. FALCONER, No. 218 Sqn.—One night in June, 1942, this airman was captain of an aircraft detailed to attack Bremen. In the light of the full moon, shortly after crossing the Dutch coast, the aircraft was intercepted by three enemy fighters whose pilots made simultaneous attacks from the port quarter, starboard and dead astern positions. Sgt. Falconer took violent evasive action but, in spite of this, his aircraft sustained severe damage. Just when it seemed that he had eluded his attackers, another enemy fighter appeared, firing a burst which raked the bomber from front to rear. The complete combat, lasting for

An Intelligence Officer inspecting the D.39 Salvator parachute which failed to open when an Italian pilot had to bale out over Malta. The D.39 is specially designed for high speed jumps. The hole at the top of its 485 sq. ft. canopy has an elastic circumference which dilates until the shock of opening has been absorbed.

20 minutes, was fought from 15,000 feet down to sea level.

With two of his crew wounded, the aircraft's turrets useless, the astrodome, blind-flying panel and oxygen system shot away, as well as other damage sustained, Sgt. Falconer set course for this country. Although subjected to strong concentration of light anti-aircraft fire near the enemy's coast he flew the aircraft safely back to base. Throughout, this airman displayed great courage, skilful captaincy and devotion to duty.

Sgt. C. J. NOLAN, No. 217 Sqn.—This airman has participated in attacks on units of an Italian naval force. In June, 1942, he scored hits on an Italian naval vessel. Some time afterwards he attacked and disabled an enemy merchant ship. Despite heavy defensive fire, he flew in and pressed home his attack. Although wounded in the leg during the run up Sgt. Nolan, despite considerable loss of blood, flew his aircraft back to base and made a safe landing.

Sgt. E. A. WALLER, No. 252 Sqn.—This airman was the observer of an aircraft which took part in an attack on the airfields at Derna. During the operation, his pilot received wounds in both legs. Sgt. Waller immediately applied a tourniquet to his comrade's right leg and then, taking over the controls, he flew the aircraft until the pilot revived. During the return journey the pilot fainted twice but on each occasion Sgt. Waller skilfully controlled the aircraft. Eventually a safe landing was made at base. Throughout, this airman displayed great coolness and resource.

Flt. Sgt. S. C. HUBBARD, No. 219 Sqn.—Flt. Sgt. Hubbard has been employed on night flying operations. He has taken part in the destruction of three enemy bombers at night. This airman has at all times displayed great keenness and devotion to duty.

Flt. Sgt. B. H. KNIGHTS, No. 104 Sqn.—This N.C.O. has completed 37 operations with the squadron. On one occasion his aircraft was attacked by an enemy fighter, the fire from which damaged one of his engines, causing it to catch fire; the undercarriage was also damaged. Despite this, Flt. Sgt. Knights coolly and skilfully manœuvred his aircraft and enabled his rear gunner to shoot down the attacker. On returning to base a crash landing had to be made, but this was done safely and the crew were uninjured.

During a daylight attack on Brest he displayed both gallantry and resource when his flight commander was attacked by enemy fighters. Although the fuselage of his leader's aircraft was ablaze and it seemed certain that it would crash, Flt. Sgt. Knights hung on in close formation and so prevented further enemy attacks on the leader. The fire in the damaged aircraft, however, was eventually extinguished and both aircraft were flown safely back to England. There is little doubt that but for this airman's bravery his flight commander would have been shot down.

In the Middle East Flt. Sgt. Knights has carried out many successful attacks on enemy objectives. He participated in the first raid on Naples. On another sortie to the same city his aircraft was attacked by three night fighers which were driven off after prolonged combat.

Flt. Sgt. G. P. RYLANDS, No. 14 Sqn.—As wireless operator/air gunner this airman has completed 45 operational sorties. His outstanding coolness, reliability and skill have made him an invaluable member of the squadron. On many occasions his clear and accurate instructions have enabled his pilot to evade attacking fighters.

Flt. Sgt. G. WHITFIELD, R.A.F.V.R., No. 206 Sqn.—Flt. Sgt. Whitfield has completed a large number of successful operational sorties, including escorts, sweeps, strikes and patrols. On two occasions with another pilot, he has prevented convoys from being attacked by enemy aircraft. Last July, when on patrol, he made a successful attack on a large anti-aircraft ship and left it burning.

His aircraft was very badly damaged, one engine caught fire and both engines stopped as a result of a direct hit on the fuel tank. Flt. Sgt. Whitfield promptly changed to another tank, got the engines working again and brought the aircraft safely home with very little fuel after a flight of 7¼ hours.

On another occasion his aircraft was damaged during a night raid on Donges oil refineries, but his successful navigation enabled the pilot to make a safe return after a flight lasting eight hours. He has set a fine example to his squadron by his conspicuous skill and devotion to duty.

Sgt. E. D. BOYCE, R.A.F.V.R., No. 104 Sqn.—This airman has participated in 40 sorties, 22 of which were over Germany and occupied territory in France. He has always shown the greatest courage and devotion to duty. On one occasion, after a night raid on Brest, one engine of his aircraft caught fire in the air. Sgt. Boyce was compelled to crash land.

Whilst operating from Malta, Sgt. Boyce received multiple injuries when an engine failed whilst landing and his aircraft crashed. After his recovery he insisted on participating in further operations. During an attack on a convoy, Sgt. Boyce scored hits on a merchant vessel which subsequently sank. He has, on many occasions, been responsible for successful attacks in most difficult conditions.

THE KING has been graciously pleased to approve the following awards in recognition of gallant and distinguished services during air operations while attached to the Royal Air Force:

THE MILITARY CROSS

Lt. (local Major) J. HEPBURN, R.A.
Lt. (temp. Capt.) J. B. MULLOCK, R.A.
Lt. (temp. Capt.) T. F. S. SOUTHGATE, R.A.
Lt. (temp. Capt.) H. G. TINGLE, R.A.
2/Lt. (act. Capt.) E. J. McD. PULLAN, R.A.

Group Capt. F. R. Banks, O.B.E., R.A.F.V.R., who is Director of Engine Production at M.A.P. Before the war Group Capt. Banks was Technical Manager and Chief Engineer of the Ethyl Corporation.

THE KING has been graciously pleased to approve the following awards:—

GEORGE CROSS (POSTHUMOUS)

L.A/C. A. M. OSBORNE.—During a period of fierce enemy air attacks on Malta, L.A/C. Osborne has displayed unsurpassed courage and devotion to duty. In circumstances of the greatest danger he was always first at hand to deal with emergencies, whether in fire fighting operations or in rescue work. The following are examples of his promptitude and gallantry:—

Rendered safe the torpedo of a burning torpedo aircraft, working three feet from the main petrol tank for ten minutes. Extinguished a burning aircraft during a heavy bombing attack. Attempted to save a burning aircraft, and subsequently removed torpedoes from the vicinity. Assisted in saving the pilot of a burning aircraft and extinguishing the fire. Saved an aircraft from destruction by fire. Attempted for six hours to extricate airmen from a bombed shelter, despite continued heavy bombing and danger from falling stone-work. Fought fires in two aircraft, his efforts resulting in the saving of one. Freed the parachute of a burning flare caught in an aircraft, enabling the pilot to taxi clear. Checked the fire in a burning aircraft, the greater part of which was undamaged.

The last three incidents occurred on the same day. L.A/C. Osborne was unfortunately killed on April 2nd, 1942. During an intense air attack he led a party to extinguish the flames of a burning aircraft. A petrol tank exploded, and he was injured and affected by the fumes. On recovery, he returned to fight the fire, and was killed by the explosion of an air vessel while attempting to pour water over torpedoes which were in danger of exploding. This airman's fearless courage and great leadership on all occasions have been beyond praise. The Air Officer Commanding, Royal Air Force Mediterranean, has stated that he was "one of the bravest airmen it has been my privilege to meet."

GEORGE MEDAL

Act. Flt. Lt. H. B. H. DICKINSON, R.A.F.V.R.—Flt. Lt. Dickinson has displayed outstanding courage, initiative and devotion to duty. When intense and almost continuous enemy air attacks were commenced against Malta he volunteered for special duties and performed dangerous work while the attacks were in progress. Flt. Lt. Dickinson displayed remarkable powers of leadership and indomitable courage. The utmost confidence has been placed in his sound judgment and initiative in duties which entailed great risk.

Act. W/O. D. BISHOP.—W/O. Bishop, who is

The new long-range Boeing Sea Ranger flying boat (XPBB-1). It is powered by two 18-cylinder Wright Duplex Cyclones of 2,000 h.p. each.

SERVICE AVIATION

employed on armament duties in Malta, has displayed exceptional courage and devotion to duty throughout a long and trying period. He has rendered invaluable service, showing an absolute disregard for his own safety. His conduct has been of the greatest benefit to his superior officer, whose services have been fully taxed during the constant air raids of the past five months.

M.B.E. (MIL.)

F/O. C. G. REEVE, R.A.F.V.R.—One night in April, 1942, F/O. Reeve was the navigator of a Stirling aircraft which crashed when landing after an operational sortie. Most members of the crew were thrown clear, but the captain and two other members were seriously injured; the captain died within a few moments. F/O. Reeve sustained a fractured vertebra and both his ankles were dislocated. Despite these painful and serious injuries he helped to drag his injured companions through a hedge and some 20 yards farther on into a field, where they were safer from the danger of exploding petrol tanks. The high courage and fortitude displayed by F/O. Reeve set a splendid example.

BRITISH EMPIRE MEDAL (MIL.)

Cpl. G. H. FREEMAN.—Cpl. Freeman, a member of the Royal Air Force Regiment, is employed as N.C.O. in charge of an anti-aircraft flight at a relief landing ground. In April, 1942, he was in a machine-gun emplacement when a Spitfire crashed about 400 yards away from him and burst into flames. Cpl. Freeman, having a bicycle at hand, hastened to the scene of the crash, where he found the pilot lying in the blazing wreckage. He immediately went into the flames, dragged the pilot clear of the burning aircraft, and, with the assistance of another airman, extinguished his burning clothing. Cpl. Freeman sustained burns to his hands and face. He displayed courage and initiative of a high order.

Cpl. J. JONES.—Cpl. Jones has displayed high courage and devotion to duty whilst employed on work of a special character in Malta. He has shown a complete disregard of his own safety.

Roll of Honour

Casualty Communique No. 143.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Act. Flt. Lt. D. R. Arkell; Act. Flt. Lt. N. C. MacQueen, D.F.C.; P/O. A. E. Scull; Sgt. K. F. W. Wale.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. N. E. Cooke; P/O. C. H. Danielsen; Sgt. R. Enticknap; Sgt. A. G. Jaye; Sgt. P. Markides; Sgt. T. H. Miller; Sgt. D. E. Mills; Sgt. C. C. Smith; Sgt. L. M. Wishart; Sgt. A. Woodcock.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Ashton; Sgt. R. V. Bawden; Sgt. A. Bess; P/O. N. E. Bishop; Sgt. R. Bramhall; Sgt. R. Broxap; P/O. R. N. Chancellor; Flt. Sgt. G. H. Chesman; Flt. Sgt. B. Clark; Sgt. J. R. Conn; Sgt. D. L. Cooke; Sgt. A. F. Daniels; Sgt. G. G. Fell; Sgt. B. Ferguson; Sgt. D. Ferguson; Sgt. L. H. Fowler; P/O. O. Gandy; Sgt. J. H. Godfrey; Sgt. T. F. Gowan; Flt. Sgt. L. C. Green; Sgt. R. A. Hamon; F/O. J. Harrop; Sgt. A. Hemming; Sgt. H. D. Higgins; Sgt. W. Hutton; Sgt. G. S. Illingworth; Sgt. K. A. Jeffreys; Sgt. M. A. Jenkins; Sgt. E. M. Jennings; Sgt. P. Johnstone; Sgt. D. D. Jones; Sgt. A. King; Sgt. J. E. King; Sgt. D. McCready; Sgt. G. A. McGarvey; Sgt. R. McGibbon; Sgt. A. J. Moore; Flt. Sgt. K. Morris; Sgt. J. K. Moss; Sgt. W. A. Nation; Sgt. C. Northcott; Sgt. P. G. Osman; Sgt. W. A. Pascoe; Sgt. J. M. F. Farnham; Sgt. W. A. Pascoe; Sgt. J. Pickup; Sgt. F. G. Rae; Sgt. D. R. Rawlings; Sgt. R. Shearer; Sgt. D. Sizmur; Sgt. J. D. Thompson; Sgt. L. R. Townsend; Sgt. H. Vickers; Sgt. A. F. Wales; Sgt. A. D. Wallace; Flt. Sgt. E. W. Walters; Sgt. W. Webster; F/O. H. E. P. Williams; Flt. Sgt. R. A. Williams; Sgt. G. N. Winter; Sgt. J. Woodward.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—P/O. D. Geffene.

WOUNDED OR INJURED IN ACTION.—Sqn. Ldr. A. G. Lewis, D.F.C.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Act. Flt. Lt. D. W. Wainwright.

MISSING, BELIEVED KILLED IN ACTION.—P/O. L. G. Barlow; Sgt. L. L. Eagleton; Sgt. D. J. East; P/O. R. W. S. Hayes; Sgt. G. W. Jackson; Flt. Sgt. B. W. Johnson; Sgt. J. Johnstone; Sgt. R. Kitney; Flt. Sgt. J. Nash; Sgt. J. P. Shipton; Sgt. H. E. Vosper.

Fighter pilot of a night-flying Hurricane in the Western Desert waves away the chocks.

MISSING.—Sgt. E. A. Allen; Sgt. R. Batman; Sgt. J. C. A. Bell; Sgt. E. P. Bradley; Sgt. D. E. Briggs; P/O. R. V. Brossmer; Sgt. W. W. Chapman; Sgt. H. Cliffe; Sgt. A. R. Clouston; Flt. Sgt. D. G. S. Corden; Sgt. R. Cowley; Sgt. G. W. Craft; Cpl. A. T. E. Daniels; Flt. Lt. B. M. Denny; Sgt. W. C. F. Dodd; F/O. A. W. Donald; Sgt. J. A. Dowling; P/O. A. S. Dryden; Sgt. R. Easten; Sgt. L. F. Evans; Sgt. L. P. D. Fordham, Act. Flt. Lt. J. R. Graham; P/O. F. Hancock; Sgt. W. B. Henvey; Sgt. S. Hextall; Sgt. F. J. Keeler; Sgt. P. N. Keeley; Sgt. R. V. Kemp; Flt. Lt. H. D. T. Leach; L.A/C.1 Lewis; Sgt. A. E. Lewry; Sgt. A. C. May; Sgt. J. C. D. McHardy; Sgt. R. L. Miller; P/O. J. H. Menary; Sgt. A. Penman; Sgt. T. J. Savage; Sgt. R. Summers; Sqn. Ldr. S. O'R. Surridge; P/O. G. Teicheira; Sgt. R. L. Vince; Act. Sgt. R. D. Walker; P/O. T. M. Welch; Sgt. A. P. Westle; P/O. G. W. Wilkinson; P/O. R. K. Wilson; Sgt. J. R. Wright.

KILLED ON ACTIVE SERVICE.—P/O. E. D. Bailey; Cpl. P. M. Clarke; Flt. Sgt. C. Cooper; Sgt. T. Crilly; Sgt. E. Cullinane; P/O. H. K. Daniel; L.A/C. W. G. Gorton; L.A/C. A. G. Hawes; L.A/C. E. R. Heaton; Sgt. J. Hinde; L.A/C. F. G. Hogg; P/O. P. Pimblett; P/O. W. B. Rice; P/O. H. H. Want; Sgt. G. H. Whitman; F/O. F. H. Williams, D.F.C.; Sgt. R. J. Williams.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. K. G. Fridd; Cpl. J. O. Kennedy; L.A/C. T. W. F. Sturman; L.A/C. D. I. Thomas.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.1 K. G. Abbott, L.A/C. H. F. Betts; Cpl. C. S. Day; L.A/C. W. Fenton; Cpl. A. B. Gillan; A/C.1 M. S. Goodhand; Cpl. J. S. Harrison; Sgt. M. Hoyes; L.A/C. W. Hoyle; A/C.1 T. O. Huggins; F/O. R. T. W. Ketton-Cremer; L.A/C. H. F. Leese; Cpl. F. Matthews; L.A/C. J. Mooney; L.A/C. J. T. Oswald; Cpl. C. Penneyston; L.A/C. F. E. Poole; L.A/C. A. Stewart; A/C.1 D. Thompson; Cpl. F. T. Williams; L.A/C. M. G. Wood; Cpl. H. Wrigley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. R. G. Prior; Act. F/O. H. A. Tyrrell.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. B. Atkinson; L.A/C. E. Jones; Sgt. W. R. McKay.

DIED ON ACTIVE SERVICE.—L.A/C. J. Brannon; A/C.2 E. H. Bailey; Cpl. T. E. Masterson; Cpl. J. McElin; Act. Cpl. A. I. McGunnigle; A/C.2 R. McSwan; Cpl. S. V. Mudge; L.A/C. J. Rourke; L.A/C. A. C. Rumsby; L.A/C. M. Stables.

Women's Auxiliary Air Force

KILLED ON ACTIVE SERVICE.—Assist. S/O. M. R. E. Grace.

DIED ON ACTIVE SERVICE.—A/CW.1 N. Goldsbrough; A/CW.1 F. M. A. Robinson.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. M. N. Read; Flt. Sgt. C. Weston.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. D. McConachie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. A. J. Cain; Sgt. E. G. Enright; Sgt. I. E. Hart; Sgt. M. A. McDonald; Sgt. T. B. Macliver; P/O. E. A. Magor.

WOUNDED OR INJURED IN ACTION.—Sgt. M. J. Shirley.

MISSING.—Sgt. C. J. Beatty; Sgt. F. H. Canning; Sgt. A. V. Cottle; Sgt. L. P. Mooney; P/O. R. C. Roberts; Sgt. N. L. Stevenson; P/O. F. A. Keck.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. A. Court; Sgt. R. L. J. Lizotte; Flt. Sgt. G. A. Lowe; Flt. Sgt. J. L. Ruthven.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. R. J. Burrell; Act. Flt. Lt. C. Fletcher.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. A. Boisvert; Sgt. F. E. Hagel; Sgt. N. G. Hickey; Sgt. A. McClintock.

MISSING.—P/O. A. W. Abbott; Sgt. E. G. Alexander; P/O. E. Atkinson; Flt. Lt. O. T. Cantrill; P/O. R. A. C. Draper; W/O. E. D. Girardot; Flt. Sgt. L. N. Hodgins; Sgt. D. S. Kennedy; Sgt. G. N. Moore; P/O. D. F. Rouleau; P/O. R. D. Shuman; P/O. S. F. Smither; Sgt. B. W. Weaver.

KILLED ON ACTIVE SERVICE.—Sgt. J. B. Lisle; Sgt. J. A. Schweitzer; Sgt. A. Walker; Sgt. J. I. Williams.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. R. A. Morrison; Sgt. A. B. Summers.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. E. J. Aitchison; Sgt. J. I. Brown.

WOUNDED OR INJURED IN ACTION.—P/O. G. W. Brewer.

MISSING.—Sgt. A. M. Dingle; Flt. Sgt. E. A. Olliver.

KILLED ON ACTIVE SERVICE.—Sgt. H. C. Crouch.

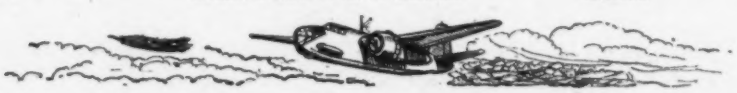
South African Air Force

MISSING, BELIEVED KILLED IN ACTION.—Lt. B. S. Thornhill Cook.

MISSING.—2/Lt. K. H. Lawlor; Capt. R. Pare.

Indian Air Force

MISSING.—P/O. S. Lakshman; P/O. F. Mousinho Nailoq.

KILLED ON ACTIVE SERVICE.—P/O. D. P. Majda.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Cadet S. Sn. Dar; P/O. D. Goordean.